SCOVILL BRASS WORKS
(Scovill Manufacturing Company)
59 Mill Street
Waterbury
New Haven County
Connecticut

HAER No. CT-153

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CONN
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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
Philadelphia, P.A. 19106

Part I: Overview of Scovill Manufacturing Company History

Contextual History
Waterbury Connecticut and the Scovill Brass Works, c. 1674- 1918

The original settlement of the land that was to be the City of Waterbury was authorized by the General Court of Connecticut in 1674. A group of men from Farmington had submitted a request for action to the Court in October of 1673, and their petition was granted to "settle a plantation at Mattatuck" in April of the next year (Bronson 1858:2). The Native American name for the area was "matetacoke" so the settlement was anglicized to Mattatuck until it was officially recognized by the General Court in 1686. The name of the settlement was changed to Waterbury at that time and it was admitted as the 28th town in the Colony of Connecticut (MHS 1974:1).

In 1686 the town of Waterbury included all or parts of the later towns of Watertown, Plymouth, Wolcott, Prospect, Naugatuck, Thomaston, and Middlebury (Brecher 1982:5). At the time of its exploration by European settlers the area was being claimed as hunting grounds by two groups of Native Americans in the towns of Farmington and Derby, where they still had relatively large settlements. Apparently there were no large Native American settlements within the bounds of 1686 Waterbury. The first group of Europeans who tried to utilize the area arrived about 1657. They had obtained a deed for "trust of land in pursuit of 'black lead'[1] on land called matetacoke." This venture may not have been successful as nothing was heard of this group or 'black lead' again (Bronson 1858:2).

There was very little activity in Mattatuck on the part of the first settlers until well after 1675 when the Indian or King Philip's War broke out. These early settlers were pushed back to Farmington during the conflict, and no record of a return trip is found until 1677 when they returned to what is now Waterbury to stay (Bronson 1858:2; Mattatuck Historical Society (MHS) 1974:1). This group settled on the east side of the Naugatuck River around what is now The Green in downtown Waterbury, more than one fourth of a mile west of the Scovill site. Records of the early town report that the area was partly swamp, with the first of many recorded floods taking place in 1691.

In between the annual flooding the area's residents were intent on building their town. The community's first saw mill and first grist mill were built on the Mad River in 1679. This was Hopkins' grist mill that would later be the home of the fledgling Scovill Manufacturing Company. The construction of saw and grist mills were important events for several years; the granting of a mill privilege was a major land transaction for the community and miller.

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[1] Black lead is a name for naturally occurring graphite.

However, in 1720 the number of saw mills was rapidly increasing and by 1730 saw or grist mills ceased being a novelty. They were built whenever and wherever they were needed (Anderson 1896 Vol. I:575-577). The town's records of 1692 show the residents were very successful at raising sheep. Several fulling mills were built on one waterway by 1709 to process the wool, giving Fulling Mill Brook its name. Many of these structures were built on the rivers in Waterbury; references to them continue through 1835. By that time it had become cheaper to purchase woollen cloth than to manufacture it and the production of domestic material had mostly ceased (Anderson 1896 Vol. I:578).

Population increased slowly in Waterbury. In 1756 there were only 1,829 residents. The city was incorporated in 1853 and the population was still only 5,137. With the impetus of the growing manufacturing enterprises and the influx of native-born and immigrant workers, the population of the city finally started increasing and reached 51,139 by 1900. Continued expansion of Waterbury's industries, especially during both World Wars, increased the rate of population growth. The U.S. Census counted 104,477 residents in 1950. The city continued to grow and in 1973 the State Department of Health placed Waterbury as the fourth largest city in Connecticut with a population of 111,800 (MHS 1974:2). See Appendix C for charts on Waterbury population growth and population by country of birth.

Brass production and manufacture made Waterbury's fortune during the 19th and the first half of the 20th centuries. The "Brass City" led the world in the brass industry and the production of brass goods. In the 1800s Waterbury led the nation in innovation and design. The city received 1,250 patents between 1808 and 1890, and Connecticut as a whole received more than any other state. The patents were divided between designs for new products and inventions of new machinery (Bucki 1980a:43). Many of these innovations were developed in the Scovill Manufacturing Company complex. From the patent brass buttons produced by Leavenworth, Hayden & Scovill to the giant continuous casting machinery invented on site in the 20th century, Scovill has been one of the larger driving forces behind Waterbury's success and reputation (Bousquet 1993: personal communication).

Increasing industrialization brought with it an increase in the diversity of the city's population. Ethnic neighborhoods formed and divided the city into "Little" countries. The new immigrant may not have had a job upon arrival in the city, but he or she knew exactly where they were going to live. As early as 1850 the immigrant population made up one-quarter of the city's residents. And most of these foreign-born workers were employed by the brass, spoon and pin factories there. For example, in 1851 Dublin Street (Hamilton Avenue) received its name because of the large Irish population living along it. In 1880, 93 families lived there and 80 of them were headed by a native Irishman. There were other streets with similar populations and the majority of them listed "brass mill" as their place of occupation (Bucki 1980a:70).

Ethnic diversity increased in the town of Waterbury after 1880. By 1890, 70% of Waterbury's population was made up of immigrants or the children of immigrants. Appendix C shows the population growth of Waterbury and the distribution of the immigrant population over the years. Ethnic neighborhoods expanded or contracted within the different wards of the city, and changed hands or wards as new groups entered and settled.

James Scovill and a group of Waterbury brass businessmen (Benedict, Holmes, and Coe) were responsible for bringing the railroad through Waterbury in 1846. The Naugatuck Railroad, known as the Meriden, Waterbury and Connecticut River Railroad by 1896, followed the route of the Naugatuck River (Studley 1981:41; Figures 5, 8, and 9). Side tracks ran through the Scovill property after 1879. By 1894 there was a public station, the Dublin Street Station, on the Scovill property near the intersections of Dublin and Bridge Streets at the end of one of the side tracks (Anderson 1896:584).

As the city grew certain services became a necessity and Scovill was integrally involved in these community efforts. Early in 1915, several of the large manufacturing companies of Waterbury co-operated with the city in the establishment of a special police or constabulary force. This group augmented the local police force by patrolling all the streets and neighborhoods surrounding factory complexes (HAER No. CT-153-112). The Scovill Manufacturing Company, with its extensive plant and equipment and large factory additions under construction, faced the need of special protection for its plant and employees. Scovill paid the constable's wages, but they were under the direct supervision of the Waterbury Department of Police (Pape 1918 Vol. I:16).

Housing also became a critical issue as Scovill added employees during increased production for World War I. Beginning in 1916, 137 homes were built by Scovill and sold to employees. These six-room row houses, following "Dutch, English, Italian, and Colonial" designs, were built on company land along Oak, Wood, and Ives Streets (Pape 1918 Vol. I:143; Bucki 1980a:77). In 1918 barracks were built for Scovill's single men on Golden Hill Street (Bucki 1980a:78).

The city of Waterbury went through 100 years of rapid economic growth. It entered the nineteenth century a small, agriculturally based community. It left it a full fledged city, with all the advantages and attendant problems that come with urbanization.

The First Brass Manufactories of the Colonial Period

John Winthrop cast the first brass in the American Colonies at the Saugus (Massachusetts) Iron Works in 1644. The experiments were technically, if not financially successful. Over the years, the technology was improved and brass cannons were cast at Saugus and at Philadelphia well before the Revolution. Philadelphia became a center for the metalworking trades[2] (Lathrop 1909:36).

Waterbury, Connecticut had some metalworking activity in the Colonial period. Before 1750 John Allen established himself as a silversmith and brass worker in Waterbury. Allen made knee and shoe buckles, repaired watches and sold buttons imported from England. In 1754 Joseph Hopkins set up shop and began making buckles.

In 1790 Henry Grilley, a buttonmaker who had learned the process in Boston from an Englishman, joined his brothers Silas and Samuel to make pewter buttons in Waterbury. It was primarily a cottage industry. The pewter was cast in a mold which included an integral "eye" or loop in the pattern. The eye was used to attach the button to clothing. Considerable hand labor was needed to finish cast buttons. Flash (excess metal at the parting line of the mold) was filed off and sprues or gates (metal from the pouring path) removed. The work involved in trimming and finishing was substantial. In 1800, the Grilley brothers eliminated some of the labor when they introduced an iron wire "eye" as a replacement for the cast eye. This resulted in a stronger, lower cost button (Lathrop 1909:37).

Rationale: Brass Industry's Origins in Waterbury

English visitors had an unfavorable view of the prospects for any manufacturing in the United States. In 1794 Thomas Cooper opined that there was some demand for itinerant tradesmen such as silversmiths and watchmakers, that a brass founder might find employment, together with iron workers, carpenters and masons; but while "land is so cheap and labor so dear, it will be too hazardous a speculation to embark a capital in any branch of manufacture which has not hitherto been actually pursued with success in this country" and " while America and England are at peace there will be little or no temptation to set up manufactures in ... [this country]" (Lathrop 1909:48).

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[2] Between 1725 and 1775, a Philadelphian identified as Caspar Wistar and his workers produced stills and kettles of brass or copper. They also cast some brass items (Lathrop 1909:36).

How did Waterbury come to emerge as a center for the button industry? The main reason was that Waterbury had limited agricultural resources. Soil was poor and rocky, all the good farms were taken. The original settlers had the choice of leaving, starving or getting into some industrial venture (Lathrop 1909:45). Waterbury had sufficient power resources in the Mad and Naugatuck Rivers for the industrial requirements of the period. Wood needed for melting and annealing was abundant. Raw and finished-material transport was not a problem. The amount of material required for buttons was small and scrap metal was available almost anywhere. Shipping was simple, a peddlar could carry on his back or in a wagon a considerable supply of low bulk and weight items. The cost of transport of a dozen buttons was insignificant (Lathrop 1909: 44).

Waterbury had skilled craftsmen--the Porters, Grilleys and the Scovills. It also had Aaron Benedict and Israel Coe who competed with them. David Hayden was an "outsider" from Attleboro, Massachusetts, who was attracted to Waterbury because of its growing brass industry (Lathrop 1909:46). So Waterbury, like other towns in Connecticut had the necessities for supporting manufactories.

Waterbury's Brass Industry and Scovill's Origins

During the years when the metal trades were making a tentative start in the colonies, a founder of Waterbury's brass industry was born. Abel Porter entered this world in 1757 at Kensington, presently a section of Berlin, Connecticut. He and his younger brother Levi Goodwin were sons of Gideon and Huldah Porter, descendants of an old Haddam family (Scovill Manufacturing Co. (SMC) 1952a:3).

Porter fought in the Revolution; he enlisted twice under George Washington. After the war he settled down to the tinners (tinsmiths) trade in Southington. He learned metalworking from one Solomon Dunham. Porter married Dunham's daughter who died soon thereafter in 1783.[3]

In 1784 Porter remarried to Hannah Eliot, a descendent of John Eliot, the distinguished apostle to the Indians. On May 7, 1795 he bought a house and shop located at Main Street and Meriden Avenue in Southington where he lived and worked until moving to Waterbury (SMC 1952a:4).

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[3] Thus Porter became related by marriage to William Pattison. Pattison was a Berlin, Connecticut tinsmith who is credited with having started the manufacturing of American made tin household cooking and eating utensils in 1740 (Brass Roots:3).

After the Revolution there was a scarcity of cash and a reluctance to buy British goods. Domestic craftsmen and door to door peddlers were ready to satisfy the demand for inexpensive goods. Porter's tinker business was successful; the Federal census of 1800 indicates he had four or five young apprentices, resident in his household.

Abel Porter and his brother were already manufacturing pewter buttons when the opportunity to expand into the high quality brass and silver button market presented itself. This was a period in our history when the concept of mass production of interchangeable parts was just beginning to gain credence. The idea could also be applied to the quantity production of identical parts which did not necessarily require interchangeability. The concept was originated in 1765 by General Jean-Baptiste de Gribeauval who introduced standardized weapons with standardized parts to the French military (Hounshell 1984:25). Revolutionary soldiers had been exposed to the concept through the French officers who trained the Americans.

Previously, quality buttons of brass or silver were imported or made to order for a limited custom trade. While Great Britain had the technology for producing brass sheet, manufacturers still relied on hand labor and skilled craftsmen to produce essentially custom made products. Connecticut button makers were to become engaged in an early effort of American industry to mass produce a quality product to sell at a reasonable price to the public (SMC 1952a:5). To do this they needed brass sheet stock. The quantity production of the finished brass sheet, the machinery and the skilled craftsmen required, were secrets closely guarded by the English government and industry.

The British government didn't take the threat of competition too seriously at this time. Lord Sheffield's *Observations on the Commerce of the American States - 1804,* had declared that the United States would be supplied with iron and steel from England for a long period. Tin plates and copper in sheets for fabricating kitchen utensils could <u>only</u> be had "from Great Britain to any advantage". As for buttons, Lord Sheffield declared "this will be one of the last manufactures which it will be worth the while of the Americans to attempt" (Sheffield: Lathrop 1804:48).

In spite of Lord Sheffield's gloomy prediction, manufacturing of metal buttons was becoming important in Waterbury about this time. Methods were developed for making cheap cast or stamped buttons (SMC 1952a:4). Porter had a knowledge of pewter and block tin casting. He had also experimented with hand stamping buttons from imported or scrap brass and copper strip (SMC 1952a:4). Porter's experiments showed that cold rolled brass strip was best for making buttons. No domestic material was available except as scrap of uncertain composition, thickness, temper and availability (SMC 1952a:8).

Between 1798-1800 Porter began to explore the possibility of setting up a button manufactory in Waterbury. He bought land, met Daniel Clark, a future partner, and sold his business in Southington. He became acquainted with other craftsmen who could contribute to the enterprise.

Silas Grilley was a successful button maker in Waterbury when the Porters contacted him in the late 1790's. In 1802 he discussed setting up partnership with Silas Grilley and Daniel Clark (SMC 1952a:5).

The firm that became the Scovill Manufacturing Company in Waterbury, Connecticut began with Porter and his partners. Grilley was knowledgeable in the process of casting pewter buttons and the three agreed a pooling of skills and resources would result in more profits for all. Silas Grilley had a friend in Daniel Clark, the son of a wealthy land owner in Waterbury. As the fourth partner, Clark provided most of the capital for the new business. David Hayden, a button maker from Attleboro, Massachusetts was also called in to join the business. He came to Waterbury in 1804 (SMC 1952a:4).

On Sept 7, 1802 Porter acquired land at the present day intersection of Meadow and South Main Streets in Waterbury, approximately a quarter of a mile west of the project site. Abel Porter & Company opened for business, in the rear of a shop located at what is now 355-359 South Main Street. (Anderson 1896 Vol. II: 275) He was 45 years old when he began to transfer his business to Waterbury. The Porter's brought capital, tools and equipment from their Southington tinners shop (SMC 1952a:5).

They made tin and pewter alloy buttons, cast and stamped brass and copper buttons, and gold finished buttons made from all the metals. Abel Porter is credited with being one of the first inventors in the United States to develop a method for gilding buttons made from "soft" and "hard" metals.

Grilley contributed an invention also. He had originated a type of wire eye pewter button, already being produced by his firm. Clark had family connections which made it possible for the partners to acquire the water rights to the Hopkins mill on Mad River. The first product made in the new shop was pewter buttons. Four partners and nine employees began to cut or stamp hard buttons from brass and copper scrap. They succeeded in raising the heat of their pit fires high enough to melt scrap brass alloys. Sources were old stills, kettles, sugar boilers, ship sheathing and the like (SMC 1952a:6). They learned to cast "hard" copper alloy buttons in individual button molds. They used Porter's fire gilding process to apply gold to their buttons (SMC 1952a:7). The technology rapidly advanced from the casting of low temperature soft tin and pewter alloys to casting "hard" buttons of scrap brass and copper.

Abel Porter & Company were hard working craftsmen, proficient in metal working and button making. Together they formed a pool of skills and capital to pioneer the establishment of a brass industry in America (SMC 1952a:3).

Between 1806 and 1809 the firm began experiments with casting brass into small ingots. Casting brass bars required new types of molds. Cold rolling required considerable power (SMC 1952a:8). The first successful bar castings used for subsequent cold rolling were produced in this shop sometime between 1806 and 1809 (SMC 1952a:8). Porter obtained a set of 2" rolls for cold rolling the brass into strips. (Anderson 1896 Vol. II:275) Porter was not the first to roll non-ferrous metal in commercial quantities. That distinction belonged to Paul Revere whose Revere Copper Company in Canton, Massachusetts had been rolling copper since 1801. But Porter's was the first brass rolling operation.

The small rollers were insufficient to handle the initial manipulation of the ingots and for the first few years the company's brass was taken to an iron rolling mill in Bantam Falls, then Bradleyville, in Litchfield. There they were roughed rolled then returned to the South Main Street shop for the finishing process.

This was also the first use in America of brass made by fusing metallic copper and zinc rather than by the earlier calamine method.[4] The button shapes were struck by dies which were concave, convex or oval; the faces were then gilded. There was a brisk demand for such buttons, which traditionally had been imported from Birmingham, England for military uniforms. Porter's process for gilding was not very efficient. It cost three dollars a gross for the gold to do the process; the English had a process that gilded a gross with six cents worth of gold (Lathrop 1909:39)[5].

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[4] In the Middle Ages brass was made by pouring molten copper into water to make copper granules. These granules were fused with calamine, a naturally occurring ore composed of zinc silicate. When these materials reacted together, they formed globules of brass. The yield was improved by adding charcoal. The globules varied in zinc to copper ratio depending on the composition of the ores used. The alchemists "eye" and experience were used to adjust composition. The globules were remelted and more calamine or copper added to obtain the proper ratio (Lathrop 1909:9).

[5] JoAnne Yates' comprehensive study of communications within American corporations, Control through Communication, has a concise note on archival collections of Scovill historical materials:

> General historical information on Scovill comes from several formal and informal histories, many of which are found in the Scovill collection at the Baker Library of Harvard Business School. Most important among the historical accounts are the following: Philip W. Bishop, unpublished manuscript history (ca. 1950), case 59, Scovill 2; E. H. Davis, "Recollections of Scovill and Waterbury, 1916-1968," informal memoir, case 59, Scovill 2; "Scovill - The Story of 150 Years of Ingenuity," unpublished historical sketch, no author, case 59, Scovill 2; Theodore F. Marburg, "Management Problems and Procedures of a Manufacturing Enterprise, 1802 - 1852: A Case Study of the Origin of the Scovill Manufacturing Company," Ph.D. dissertation, Clark University, 1945; and Theodore Marburg, "Company Agents in the Button and Brass Trade a

Initiation of Manufacturing at the project site in Waterbury

The formation of the Scovill Brass Works was the result of mergers, diversifications and buy-outs (Figure 11). The business prospered and on June 9, 1807 Porter and his partners bought half of the Hopkins grist mill and the rights to its water power. The remaining half of the property was purchased September 21, 1808 (SMC 1952a:9). This marks the start of brass manufacturing on the project site. The South Main Street shop was closed and the business was moved into the grist mill by 1812. For an approximate location of the grist mill see Figure 2A; the grist mill was situated immediately east of Building 14, West Plant. The grist mill itself served as the factory building and the miller's house was the company's office. Capital additions included a set of 4" x 4" rolls which were installed between 1814 and 1815. The old mill wheel only generated 7 1/2 horsepower (hp.), insufficient for powering the roll mill. Millwrights were quickly assigned to enlarging and rebuilding the wheel (SMC 1952a:11).

The placement of the mill to take advantage of the greatest and most reliable water power was critical and continued to be a concern as the works expanded. Scovill was responsible for creating several ponds and dams in the area. They were needed to provide power for their factory, but they also provided power for other local mills and factories (Anderson Vol. 1:584,588). The ground that was eventually covered by the railroad side tracks in 1896 (Figure 9) was a reservoir during the 1830s for a small button eye factory south of the Mad River near Dublin Street, now known as Hamilton Avenue (Figure 5). This button eye factory was situated approximately where the Water Treatment Plant (West Plant -Figure 2A) is now located. Through time Scovill acquired extensive riparian rights to impound sufficient water for the head, or power, necessary to operate the growing concern. This extensive reservoir system is still visible on today's landscape.

Power for the brass works was a critical and continuous concern. The Mad River could only generate 30 hp. from an overshot water wheel. In 1839 Scovill began a series of water power changes involving building upstream lakes, flumes, conduits and canals which powered overshot, breast wheels and turbines. Still water power was insufficient and production requirements forced Scovill to install its first steam engine in 1852. The 125 hp. engine was affectionately named "Sally Ann". It had a 16 foot flywheel, ran at 26 rpm and lasted 30 years (SMC 1952a:18).

Besides power, large volumes of water were required to cool the rolls when large reductions in thickness were specified. Rolls got hot and expanded several thousandths of an inch in use. This

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Century Ago," *Bulletin of the Business Historical Society 16* (February 1952):8-18. The authors of these accounts had access to primary materials, including some that have not survived to the present.

resulted in end to end sheet thickness variations. Mad River water was used for cooling rolls as well as power. As greater and greater quantities of water were required, a system of six large supply reservoirs was gradually developed (SMC 1952a:19).

While the search and acquisition of new property was going on, the partnership was changing. It was a tough business which required stamina and endurance of heat and fumes; the original founders began to drop out after four years. At the end of nine years none were left.

Leavenworth & Scovill

It was the second group of owners who made the business successful. Levi Porter had sold his share to David Hayden in late 1807. Silas Grilley sold his quarter share in 1809. In September of 1811, Porter bought out Clark and Hayden, the remaining partners. Within two days he then sold the entire property to Dr. Frederick Leavenworth,[6] James Scovill and his 22 year old son James Mitchell Lamson Scovill (SMC 1952a:11).

The War of 1812 was the impetus to establish and expand existing diverse light metal industries. At this time domestic producers made coils of metal only 1 1/2" wide. This was suitable for buttons but not acceptable for making kettles, hardware and lamps. Domestic cast iron rolls were not sound; getting good rolls was a problem since England restricted their exportation. The firm's major problem was porosity in the cast brass ingots. The critical ratio of ingot thickness to width in controlling porosity was not fully understood (SMC 1952a:13).

Leavenworth, Hayden & Scovill still shipped their brass to Litchfield to be rolled until 1815 when they completed the installation of heavier rolling equipment in the Mad River mill complex. By 1816 Scovill had set up a passable set of 8" rolls in what was once the Hopkins grist mill complex.

Leavenworth, Hayden & Scovill had been given one of the contracts to make buttons for the government during the War of 1812. They produced buttons for the Army and Navy, each division having their own design. Unfortunately for the military, the government did not have enough cloth on hand to make the uniforms for the Waterbury buttons. The partners contacted John Jacob Astor in New York who happened to have a few large flocks of sheep ready for shearing. By 1813 Leavenworth, Hayden & Scovill, together with James Scovill and Austin Steel had built and were operating a textile mill, producing woollen cloth for the government. The mill was located on an island up river from the brass mill, near the present dam south of East

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[6] Dr. Leavenworth was the brother of Mark Leavenworth, a noted Waterbury clock maker.

Main Street on the project site. [Note the "leather factory" on Figure 5.] The company was forced to give up the wool business when the peace of 1815 opened the market to inexpensive English goods.

The button business remained the main livelihood of the firm, and profits improved when they were able to reproduce the look and quality of the imported English buttons (HAER No. CT-153-118).

James Croft, an English metalworker living in Philadelphia, agreed to join the firm in 1821. Croft was sent to England to purchase machinery and hire expert workers. Croft consulted with a Birmingham caster and wrote on June 26, 1821,

> "It is his considered opinion that you cannot cast metal sound by your method and another evil, your ingots (bars) are too small--there would be greater certainty of soundness were they three times as wide . . . the metal should be poured at a very certain heat and the quicker it can cool, the better. . ." (SMC 1952a:14)

Croft and the toolmaker, Samuel Frost, reworked the casting and rolling process to create the same quality products that were coming from England. Profits immediately improved for the firm when they were able to duplicate the preferred orange tint that distinguished the imported buttons (Luscomb 1967:79).

The Scovills also had the assistance of the flamboyant Israel Holmes, who also "recruited" English brass workers and brought them to work in Waterbury's brass mills. Holmes had learned the brass business from the Scovills. He later founded six brass works in Connecticut and became the first president of Bristol Brass.

English law at that time forbade the emigration of skilled men, and Holmes made several trips to England during the 1820s to smuggle workers out of that country. English workers were eager to go to America and Holmes soon had his quota of 20 men. Guards posted at the Liverpool docks attempted to prevent embarkation. Holmes hid three recruits in wine casks and claimed to have "spirited" them aboard. The remaining 17 were taken to Wales and sailed safely on another ship. Bribes were paid to get the machinery aboard. The workers included a die sinker, a gilder and a burnisher. With the infusion of skilled craftsmen the Scovills were able to compete with the British. Holmes performed the same trick three times for other Connecticut industries.[7]

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[7] Holmes founded Holmes & Hotchkiss, part of American Brass (Wolcottville Manufacturing Company); Tuttle & Co. (Bristol Brass): American Silver Co.; Holmes, Booth & Hayden: Holmes, Booth & Atwood (which became Plume & Atwood)(Brass Roots 1952:23).

From 1820 to 1830 two firms manufacturing buttons existed in the United States; Scovill's and Aaron Benedict's Benedict and Burnham, both located in Waterbury. In 1820 Scovill employed twenty "hands" (Lathrop 1909:41). By 1830 the brass industry had been firmly established in Waterbury. Scovill began producing a wide variety of products and the technology improved to produce larger quantities and better quality.

J.M.L. Scovill & W. H. Scovill

In 1827 Leavenworth and Hayden sold their interests in the firm and Lamson had his brother William Henry Scovill join him in the business. It was renamed again to J.M.L. Scovill & W.H. Scovill. The two brothers complemented each other in the business and the brass firm soon began to expand. The new company experienced their first set back in 1829. The original button mill was burned to the ground and a new mill was built on the same site. This second button mill can be seen in the illustration of the factory as it appeared in 1835 (Figure 3). The original sketch was made by Scovill's bookkeeper of 1835, Lucien I. Bisbee (Anderson 1896 Vol. II:277-78; Van Slyck 1879:418). The Scovill Manufacturing Company weathered another fire in 1881 when again the building being used as the button mill burned and had to be rebuilt.

The original grist mill was demolished and the Scovill's first rolling mill was built on the site by 1858 (Figure 4) (SMC Brass Roots 1952:18). The long low structure in the foreground of the 1858 woodcut was the firm's office (Figure 4). It apparently stood on the site of the 17th century miller's house (Anderson 1896 Vol. I:573). This c.1840 office building was replaced in the 1870s by the three story brick <u>Rundbogenstil</u> building that is still present today (Note building 2 on Figure 2A). A c.1900 extension off building 2 added formal reception rooms and offices. This extension covered the remainder of the c.1840 office building site.

The 1829 fire was not the only problem the firm had to overcome. Beginning in 1847 a group of men "of no influence or standing" attempted to take over the Scovill property by claiming the original mill privilege had been forfeited by failure to continuously operate a grist mill (Bronson 1858:83-90; Anderson 1896 Vol. I:575). After three years of attempted negotiations and committee meetings a final vote was taken, with all of the Waterbury manufactory owners on the winning side, and the land remained in the hands of the Scovills. The original grantors of the property had voted in 1682 to give the "proprietor inhabitants the right to ease any part of the entail that they should see fit to" (Anderson 1896 Vol. I:575). Another note to the records of the committees was that the grantors had never specified what kind of mill had to occupy the site (Bronson 1858:86).

The 1830s was the decade that saw the first large scale expansion of the brass works. The button factory began to produce patent brass buttons in 1836. As it was and would continue to be a successful concern in its own right, the button business was set apart from J.M.L. Scovill & W.H. Scovill in 1839. The Scovills set up their nephew Scovill M. Buckingham and Abram Ives as new partners and ran their gilt button department under the name Scovills & Company. Their brother-in-law John Buckingham ran the subsidiary company Scovills & Buckingham in Oakville making brass butts, snuffer trays, belt ornaments and other small brass objects. W.R. Hitchcock & Co. made cloth buttons in partnership with the Scovills. This firm eventually occupied a factory off the project site on North Main Street, in Waterbury, the site of the Waterbury Manufacturing Company (Van Slyck 1879:418, Pape 1918 Vol. I:206).

The Scovills did not limit their business acumen to Connecticut. To ensure an uninterrupted supply of copper for their plant in Waterbury, J.M.L. Scovill and a group of Waterbury men formed the Waterbury & Detroit Copper Company. The Lake Superior copper deposit had been discovered in 1840 and the Waterbury associates were the first to build smelters for reducing the copper at the mines (Studley 1981:41).

The French inventor Da Guerre had created his photographic process in 1839. In 1840 the invention had crossed the Atlantic and by 1842 the Scovills were producing the silver-on-copper daguerreotypes in Waterbury. The daguerreotypes required metal mats, preservers and storage cases. They were the largest American manufacturer of the plates until the ambrotype, tintype and dry plate processing replaced the daguerreotypes in the early 1870s. Scovill adapted with the changes in technology and the photography branch of the Scovill's business became a very profitable one (Anderson 1896 Vol. II:278). Between 1850 and 1874 Scovill's photography division made as much in profits ($1,064,151) as its brass business ($1,100,761) (Bucki 1980a:30).

A separate corporation was spun off to handle the photographic business around 1889. The new firm was a significant departure from the core metal business. Scovill had acquired patents to camera designs and, with New York City's Edward Anthony, were agents for other name brand cameras. Samuel Peck had patented his early plastic in New Haven in 1854. Scovill had him making plastic camera parts in his New Haven factory by 1855, and had a camera factory operating in New York as well. The new firm was based in New York and was named Scovill & Adams. The E. & H.T. Anthony Company merged with Scovill & Adams in 1902 and formed Anthony & Scovill Company, later to become ANSCO (Bucki 1980a:30-31).

Samuel Peck had opened up a new product line for Scovill with his invention of an early thermoplastic material made of gum shellac and wood fibers. The composition could be heated and molded or formed by dies. The molding operation was moved to Waterbury in 1883 when Peck's New Haven company went out of business. This department produced buttons, knobs, cigar molds and one of the more memorable orders included poker chips and billiard balls (Bucki 1980a:31).

The Scovill Manufacturing Company

Almost all of the Scovill holdings were incorporated into The Scovill Manufacturing Company in 1850 (Figure 11). W.R. Hitchcock & Company remained an independent firm. J.M.L. Scovill was the first president of the company and his brother William took the office of Treasurer.

After the 1850 incorporation, the Scovill Manufacturing Company slowly initiated improvements in its management system. "In the company's first half century, oral methods of management dominated in the workplace, and the written communication demanded by distance was equally ad hoc" (Yates 1989:162). The 1849 arrival of the telegraph and railroad to Waterbury greatly increased the company's ability to quickly communicate not only with outside agents but with their own wholesale store that had opened in New York just three years earlier. In addition, there was a significant postal rate reduction between 1845 and 1851 that made constant communication with non-local interests much more economical.

The company began rolling German Silver at this time. Decorative metal objects also began to be produced through a new process developed by one of its employees. With this process silver, gold or platinum plated copper was turned into coach lamps, carriage and harness trim, and similar objects (Van Slyck 1879:419-420). Many other products were created at Scovill in the mid to late 1800s. They experimented in aluminum, produced and circulated coins as U.S. currency, and made metals for an 1893 exposition. (See Appendix A for a chronological list of products.)

Highly skilled artisans were necessary for many types of brass production; however, as production increasingly relied on mechanization, the Waterbury brass companies hired more native-born female workers and less-skilled European immigrants to work in their factories (Moloney 1993:20). Of the women in the formal labor force in Waterbury, 35 percent were employed in the metal industries (Moloney 1993:25).

During the late nineteenth century many immigrant women in Waterbury relied on industrial out work for economic support. Brass manufacturers typically hired outworkers for a variety of finishing work that could be performed in their residences, specifically to card hooks, eyes, and safety pins and to assemble sectional parts. By the end of the first decade of the twentieth century, however, the mechanization of the industry greatly reduced the need for out work, or home work. (Moloney 1993:28)

The management team of Sperry and Goss, as secretary and treasurer respectively, proved to be the driving force at Scovill for the last four decades of the nineteenth century. Sperry and Goss, originally hired as bookkeepers c.1863, respected and cultivated the written record. They established a new system of accounts and monthly reports that provided a method of evaluating the foremen and of encouraging and controlling firm growth. (Yates 1989:164-165). "The company grew rapidly during this period: the 1850 workforce of 157 doubled to 314 by 1874, then almost tripled again to 1,157 workers by 1892" (Yates 1989:164). Although Goss and Sperry introduced new management practices and communication channels, the first internal telephone system to connect the office and the various plant buildings was installed c.1881, work in the factory still depended on ad hoc management. Foremen still controlled the shop floor, establishing their own rules and communicating with their workers orally. Scovill did not even post a set of general rules. (Yates 1989:167-168)

After the turn of the century Scovill Manufacturing Company went through another period of expansion. Goss and Sperry served consecutively as very successful company presidents until 1920. The firm grew to four thousand employees by 1914. "With this growth and the addition of more brass products to its line came inevitable changes in structure. The managerial hierarchy expanded, with department superintendents supervising an increasing number of foremen and subforemen. In the early twentieth century, the division of basic manufacturing into Button, Burner, and Rolling Mill departments began to break down and various other configurations were tried. By 1911, production had been consolidated into a single department that was divided into seven divisions known as classifications. These numbered classifications had a total of fifty-four subdivisions under them. This complicated structure covered only manufacturing; other structures evolved for marketing, supply, accounting, and other departments." (Yates 1989:169)

By 1909, Connecticut manufactured 44.6 percent of America's output of brass, bronze, and their products; Waterbury alone accounted for 21.3 percent of American's brass and bronze products (Moloney 1993:20). Manufacturing the first decade of the twentieth century Waterbury's population was expanding rapidly. The early ethnic neighborhoods grew and new ones came into being to house a diversity of immigrants. By 1900 Irish immigrants constituted 44 percent of Waterbury's population:

> Lithuanians first began arriving in Waterbury in the 1890s, as many left their homeland to avoid service in the Russian army as well as to improve their economic circumstances. Emigration from Lithuania to the United States increased further following the start of the Russo-Japanese war in 1904. Italians also began settling in the city in this period and became the largest of the "new" immigrant population (Moloney 1993:20-21).

As Europe headed towards war the market for American munitions manufacturers expanded. Semi-skilled immigrant labor was available to fill newly created jobs. From 1901 through 1916, 63 buildings were added to the brass works complex. (See Appendix D for a listing of the factory buildings as of 1978.) Munitions manufacturing began in the late 1800s, but foreign orders multiplied with the beginning of World War 1 and orders increased again when the U.S. entered the conflict in 1917.

Along with the expanded business came a need for modern management techniques. During the decade 1905-1915 Goss initiated communication devices that began the process of limiting the foremen's power (Yates 1989:170). Managerial control was asserted through a series of notices, manuals, charts and scales, Superintendent's Orders, and, eventually, the company newsletter (*The Scovill Foremen's Association News/The Scovill Bulletin*). Scovill was quick to adopt new management techniques. Frederick Winslow Taylor's book, Scientific Management was a company "bible." The company pioneered in the use of time and motion study. These techniques ultimately resulted in labor unrest.

Scovill did take an interest in the welfare of employees in the Waterbury community. The company adopted paternalistic policies in the early twentieth century. They built local housing for the workers and their families during World War I and barracks for the single men complete with a restaurant. A hospital was set up on site in 1914 for the workers and family members (Pape 1918 Vol. I:209). Scovill employees generally showed loyalty to their company. Most were contented with their jobs. The most highly skilled workers often functioned as independent contractors. Expanding mechanization, scientific metallurgy and increasing management concern with time study methods contributed to de-skilling the workers and labor unrest in the early decades of the twentieth century. Before scientific management set in, it was not unusual to find lists of employees who had worked devotedly at the mills for 20 years and longer.

Scovill responded to the national welfare movement with various programs. Safety concerns in all types of manufacturing complexes were an off-shoot of this movement. Scovill's participation in The Safety First Movement included exhortations on both principles and general procedures. The company newsletter promoted the welfare of employees by promoting safety as a value. World War I expansion of the complex included a great influx of immigrant labor which Scovill responded to with English classes and other forms of welfare efforts. (Yates 1989:194, 197)

Scovill Manufacturing Company's history after World War II can be traced through its acquisitions. The company began to slowly disentangle itself from its dependence on the brass industry and began to diversify into smaller scale operations. For example, in 1967 they purchased NuTone and in the 1970s they took over the production of small appliances with the purchase of Dominion Electric. (See Appendix A for a chronology of Scovill purchases and products.) By 1976 Scovill made its move out of Waterbury and sold the huge brass works to Century Brass Products Incorporated.

Part II: Brass Processing Technology

Historical Evolution of Brass Metallurgy

To understand Scovill and the factors that shaped its operations it is worthwhile to explore the development of brass metallurgy. Most of the material on the manufacture of brass in this section was abstracted from Casting of Brass and Bronze by Daniel R. Hull[8].

Brass is primarily an alloy of copper and zinc. Although brass artifacts dating from the fourth and fifth millennia B.C. have been recovered in China, they are generally considered to be intrusive pieces of modern metal or alloys formed from the coincidental smelting of zinc silicate ore with copper (Maddin 1986:13). While the ancestry of brass may not be as ancient as the Chinese artifacts would indicate, nevertheless the metallurgy of copper alloys has a long history. Bronze was made and cast in China in prehistoric times. Copper and its alloys were found in Egyptian tombs which existed before 2000 BC (Lathrop 1909:8).

Brass is related to copper in the way that iron and steel are linked. Brass can be highly polished and is harder than copper. It is highly ductile and malleable. It is not a particularly good conductor of heat but melts readily. Brass exhibits outstanding resistance to corrosion. Brass is too expensive to be used in large castings or in heavy construction work. Brass cannot be tempered or hardened readily and will not hold a cutting edge. Early man used copper and copper hardened with tin to make weapons and tools.

Copper was softer than iron and was easily formed. It is probable that the method of hardening of pure copper with tin was the "lost art" of tempering copper (Lathrop 1909:7-8).

The origin of the English word "brass" is clouded in mystery. Determining the derivation is difficult because the Greeks and Romans used the same word for copper, brass and bronze, which is an alloy of tin and copper. The Roman Empire was well acquainted with brass and bronze. Pliny the Elder mentions that brass was used shortly after the founding of Rome. Roman brass workers were recognized as a trade guild. In Roman times the most widely used copper alloy was bronze employed as coinage. The alloy contained 80 to 85 % copper with the

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[8] Daniel Hull wrote Casting of Brass and Bronze in 1950 while he was Assistant Technical Manager of the American Brass Company. Early in his career he had worked at the Scovill Brass Works and the referenced photographs were taken at both companies. The material is not necessarily specific to operations at Scovill, but can be considered a good general overview of operations in a brass casting shop.

remainder being tin. After the beginning of the Christian era increasing amounts of lead, zinc and antimony appeared in the alloy. This was not due to greater metallurgical sophistication but rather caused by impurities introduced from increasingly poor sources of ore.

About A.D. 900, the art of casting bronze and other alloys of copper was lost for three centuries. After A.D. 1200, controlled composition brass appears once again. The varying alloy proportions of copper with tin, lead, antimony and other metals were developed about this time. The effect of these elements on alloy properties was also determined (Lathrop 1909:9).

Technological Development

About the middle of the 18th century the chemical composition of calamine (zinc silicate) was understood and metallic zinc was made available for alloying with copper.[9] In 1781, James Emerson in England, developed the modern process for making brass by direct fusion (alloying) of copper and zinc (Lathrop 1909:10). It required much greater heat for a longer time than the old tinner's charcoal fire could supply.

Originally brass was melted in small crucibles carrying 5 - 10 lbs. per charge. After melting it was poured into little band and wedge type cast iron molds having a cavity of 7 1/2" x 1 1/2" x 5/16". (HAER CT-153-121) This made a slab weighing about one pound after removal of the gate (SMC 1952a:9).

Scovill's mid 19th century process started out similarly with preparation of ingots (also called billets or bars). Depending on the ultimate use of the alloy, small amounts of metals besides zinc would be added to modify the properties. For casting brass, lead was added to increase fluidity and the ability to enter small details in a mold. Antimony was added to harden brass at the expense of ductility. Hundreds of alloy compositions were made over the years. The principal alloys were:

Gilding alloy 95% Copper, 5% zinc
Commercial bronze 90% Copper
Red brass 85% Copper
Low Brass 80% Copper
Cartridge Brass 70% Copper

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[9] In the ancient world "native" (metal in the pure form) copper was found on the island of Cyprus and in Spain and Cornwall (England). Tin was found in Cornwall. The Phoenicians traded in both of these metals. Zinc was not known to the ancient metallurgists and was not an article of commerce until the 18th century. Zinc is always found as a mineral, it is extremely rare in the native form (Lathrop 1909:7).

Casting of Brass and Bronze

The men who cast brass before the advent of 20th century scientific metallurgy were supreme masters of an arcane craft. They needed a great deal of practical but obscure knowledge to ply their craft. They sweated and labored mightily amid roaring fires, crucibles of molten metal, coal dust and the thick white fumes of zinc oxide. They trembled with the ills of 'spelter[10] shakes' from zinc poisoning. They helped make Connecticut a leader in the American industrial revolution and hardware capital of the world. For most of the nineteenth century, the breed was native to the Naugatuck Valley. Many of them were part-time farmers and combined work in the mills with agriculture.

Alloying copper and zinc to make brass or with tin to make bronze was strenuous and exhausting work. In winter zinc fumes would form a cloud close to the casting room floor. Breathing them caused a temporary palsy known as the 'spelter shakes'. In summer the heat stretched the limits of human endurance. The smells of lard oil smoke, hot iron and zinc fumes permeated the air. Shop workers were generally black with soot from the coal fires and grime that blanketed the shop floor. Yet, the risks, hardships and pay that went with the job inspired respect for the brass casters. Within its framework of medieval alchemy and a touch of wizardry, the casters job was held in awe.

The Brass Casting Crew

The heart of the brass industry was the casting operation. Before brass could be made into sheet, strip, rods, bars wire or extruded shapes, it had to be formed as an alloy of zinc and copper, then cast into a suitably shaped billet. This fundamental process was performed throughout most of the nineteenth century by teams of men under the oversight of a brass caster. Each member of the team had specific skills and responsibilities and they worked together to produce cast slabs and rods for processing into mill products. The workers were dependent on each other for safe operation of the equipment, product quality and making the daily quota of cast metal.

The old-time brass caster was a true "boss" and leader of his crew. He alone decided what the mix in the furnace was. He judged heat intensity by "eye" and developed a "feel" for proper pouring time (SMC 1952a:17). In the earliest days of the industry, the caster hired his own helpers and paid them personally from his own wages. He contracted with his employer, hired his own helpers, and handled his casting team. By 1900 this custom had disappeared and operating companies paid the workers directly. The dominant role of the caster was further reduced when metallurgical controls and production supervision were established around 1908. Laboratory analysis of each batch circumvented the casters who had held the secrets of brass chemistry and alloying. Engineering Societies and manufacturing technicians were by then,

[10] Spelter was the common name for zinc.

setting up specifications and standards governing the chemical and physical properties of all commercial metals. Modern scientific methods and controls ultimately ended the authority of the old time brass men who had ruled the shop for three-quarters of a century.

By 1900 brass manufacture had been practiced for about 75 years in the United States. Yet methods were still primitive and product quality was dependent on the experienced 'eyes and ears' of the artisan. The pot casting method was highly labor intensive, yet it lasted in production work until circa 1918. Brass was made by melting scrap and copper in a crucible then adding zinc to the molten metals. It seems like an rudimentary process but it was intricate and dangerous. Estimating the right time and temperature when to add each component was a critical skill. Work was assigned by the 'stint' system. Under this setup a caster and two or three helpers were assigned eight to ten fire pits and the tools and equipment necessary to tend them. Their assignment was to make an established daily quota of metal.

The caster was responsible for weighing out copper, zinc and scrap. He assisted in tending the fires and in adding zinc to the batch, a process called 'speltering'. The fireman tended the hearth and charged the crucibles with scrap. He was responsible for preheating the copper ingots by carefully placing them around the top of the crucible and adding zinc at the right time.

The third member of a crew was a 'puller' (HAER No. CT-153-121) who assisted the fireman, oiled and banded the molds, removed castings from the mold and filed the edges left by the parting line of the mold (Hull 1950:4).

Alloying Copper and Zinc

Making the alloy of zinc and copper required a lot of practical knowledge. Copper melts at 1083 degrees C (1981 degrees F) while zinc vaporizes at that temperature. Consequently some zinc was always lost by volatilization or oxidation during the melting process.[11]

Unless the ingredients were added at the right time and rate, with due regard for temperature, the zinc would vaporize off as 'spelter smoke' and leave a copper rich alloy. Worse, the zinc could vaporize within the melt and cause porosity, voids in the metal or precipitate a dangerous boil over.

[11] The volatile zinc formed fumes which were inhaled by the workers. In the short term, the fumes produced a palsy or tremors of the hands. It was observed that whiskey cured the shakes resulting from inhalation of zinc fumes; consequently some casters teetered between inability to work due to drunkenness or excessive zinc fume inhalation.

Typically the crew produced four or five batches or 'rounds' from the group of fires under their supervision. They stayed on the job until the quota of metal had been made -- ten and twelve hour days were common.

Work in the casting shop started before daylight. Charcoal fueled pit fires for brass melting had been superseded after 1830 by anthracite coal fires. Coal was burned in a similar type of pit which was connected into a high brick square chimney to create a draft (Figure 12). Coal was shoveled on to the grate at the bottom of the fire pit. Then a layer of charcoal was added. This was ignited with live coals or kerosine and cotton waste. The fireman placed a pot or crucible on the burning coal and filled the space around it with more coal. While the fireman prepared the pit, the caster weighed out his batch of copper and zinc which weighed about 150 lbs. Using a sledge hammer and anvil, the junior member of the crew broke up zinc ingots into smaller pieces. Then he cleaned, oiled and assembled molds.

The crew might break for a quick breakfast. Then back to work -- the fireman added brass scrap to the pot and laid copper ingots around the rim of the pot to warm. More scrap and charcoal were added to the pot. The charcoal maintained a reducing atmosphere in the pot -- it prevented oxidation of the metals. When the copper ingots were red hot they were pushed into the pot along with additional charcoal. Experience played a major part in knowing when to add the copper ingots. If the caster waited too long, the ingots would melt and run into the coal bed surrounding the pot. Nothing would ruin a fire for the day more quickly than a mass of molten metal in the fire pit. It also made clean-up time consuming; the fire pit had to be punched out with a heavy chisel-ended steel bar. Conversely, if added too soon, the ingots would not melt rapidly in the molten scrap brass; this would slow the work considerably.

Once the copper was 'down', zinc was added. This operation was called speltering. There was an ironclad rule that no zinc should be added until the temperature was high enough to vaporize[12] it. Shop lore held that a pot speltered when 'cold' would not produce acceptable uniformly alloyed brass. It took skill and strength to grasp the zinc slab in long handled tongs and lower it into a pot of molten metal quickly enough to prevent vaporization, boiling over and subsequent eruption of molten metal into the fire pit.

Molds and Casting

Once the brass had been alloyed, the molten metal was poured into a slab mold or formed into "pigs" (HAER No. CT-153-113). The earliest slab molds were made out of soapstone but by the turn of the century cast iron was in common use. A grade of high-silicon, low manganese,

[12] Zinc melts at 419.4 degrees C. (787 degrees F.) and boils at 907 degrees C. (1665 degrees F.).

low carbon iron was developed for all molds (Hull 1950:115). To form flat slabs a two piece mold was used. The front and back sections were held together with surrounding metal bands and wedges (HAER No. CT-153-122). The wedges were forced between the band and the mold to drive sections of the mold tightly together (Figure 13). It was not possible to wedge the box-like mold cover against the flat back of the mold tightly enough to prevent a small gap where the pieces of the mold met. Molten metal filled this gap and formed a fin at the edge of the slab. Usually the junior member of the crew was designated to file this fin off. Slabs varied from 3 1/2 to 18 inches in width and were about 1 inch thick. Slabs destined for the strip and sheet mills ranged from 50 to 75 lbs. -- generally the weight which could be handled by one man. Two or three slabs could be made from the contents of one pot. Some 250 lb. slabs were cast for two man handling methods but the overall scale of operations did not change significantly until mechanical handling methods were introduced in the 1930s.

The molds used for forming slabs, rods and tubes when pot casting was the dominant technology, were made of iron. Iron mold were hard to clean and had to be cooled between pourings. Hot molds were a cause of surface blisters in the casting. The molds were 'dressed' or lubricated with lard oil which burned off as the mold was filled. The vapors of hot oil displaced air in the mold and reduced metal oxidation.

Oil also prevented dirt from becoming embedded in the surface of the casting. As the metal column rose in the mold, fresh areas of the oiled mold surface were covered with molten metal. This oil would vaporize and vigorously blast dirt to the pouring surface. If insufficient oil was used or if the column rose too slowly to keep the action at the mold/metal interface energetic, dirt inclusions would be embedded in the surface of the casing. Some of the zinc in the molten brass also escaped as vapor and oxidized, depositing zinc oxide on the face of the mold.

Too much oil could form a trapped bubble of gas and develop into a blister on the surface of the casting. Excessive oil could be trapped before it vaporized. When it did vaporize it could throw metal out of the mold with a spectacular explosion.

The old time caster used his senses to gage whether the pouring process was proceeding satisfactorily. His pouring rate was regulated by the sound of metal entering the mold. A gentle hiss was desired while a staccato vibration was an indication of to rapid a pour. He used his eyes to determine how the metal settled in the mold. If poured too fast, the metal was flung about by the rapid decomposition of the lard oil mold lubricant. Blisters would form on the surface of the casting. If poured too slowly, metal could solidify on the surface of the mold and leave internal voids. Narrower molds were poured directly from the melting crucible which was balanced on the edge of the mold. An iron skimmer or strainer was inserted in the stream of molten metal. This was a simple shallow pan with multiple small holes punched through it. The skimmer strained out dross, bits of charcoal and held back a block of wood that was sometimes placed on top of the molten metal in the pot to help prevent oxidation.

Several types of molds were developed to conform to the peculiarities of the alloy composition and the end product desired. The objective of mold design was to control solidification and thus make a bar free of internal voids. The shape of the casting was specifically developed for rolling into strip, making rods and wire or forming tubes. Besides the slab molds there were multiple compartment 'book' molds in which several bars could be cast with each pour.

Naval brasses were cast in a ring mold, a simple cast iron ring 4 to 12 inches deep with a wall thickness of 2 to 10 inches (HAER No. CT-153-127). The inside diameter varied from 2 to 4 feet. The ring was heavy enough to bear solidly on a base plate of cast iron, mild steel or copper and prevent any leakage. The cavity formed by the ring would be filled with molten metal and skimmed of dross. A sprinkling of borax and fluorspar prevented additional dross or oxide formation. Before the casting was run through the rolling mill, the top surface would be machined off in a boring mill.

'Cake molds' were developed for producing billets destined for the strip mills. The edge poured cake mold formed blocks 6 to 8 inches thick, 3 to 4 feet long in the horizontal dimension, with a height not more than two or three times the thickness (HARE No. CT-153-124, 125). In a cake mold, solidification proceeded simultaneously from the sides and bottom. The caster was able to continuously feed molten metal into the center of the casting as it cooled. This compensated for shrinkage and formed a billet free of voids.

Hollow cylindrical molds were used to cast rods. The one piece 'cannon' mold was developed around 1900 for cylindrical shapes (Figure 14). Cannon molds are cast iron cylinders with the center bored out. There was no need for banding and the mold swiveled on a trunion so it could be lowered into a horizontal position to remove the casting. It could be cooled between pours by sprinkling with water.

The Lawton mold was a variant of the banded mold. In a Lawton mold the cover section was hinged at the bottom. To close the mold the eover was swung up against the back. The back section protruded into the cover section for a fraction of an inch and there was a machined fit between components. The joint between the cover and back did not depend on butting two flat surfaces together tightly and. Elimination of the gap between mold sections did away with the need for filing the fin at the parting line. The two sections were held together by substantial hooks (Hull 1950:139).

After cooling the resultant castings were given a set of "passes" through a rolling mill, with intermediate anneals between roll sequences, until the finish thickness or gauge was reached (CT-153-114, 115). Rods had a tendeney to distort and twist as they were processed. They were run through a set of straightening rolls to remove bends (HAER No. CT-153-117).

The first rolls were cast iron with a chilled surface. Greater compression with smaller roll gaps required alloyed cast iron rolls. Eventually cast steel became the standard for rolls. Bearing materials progressed through the years from babbitt metal to bronze to fibre and antifriction roller and ball types (SMC 1952a:18).

As strips became longer and longer it became necessary to develop mechanical coilers to collect the brass coming from the rolls. In 1886, hand "blocking" (aligning the edge of successive layers of sheet on the rolled coil) with a mechanical winder was introduced. By 1905 the automatic mechanical blocker was added. The main skill of the roll mill operator was his ability to impart proper shape or "track" in the rolls by "stick grinding." Perfectly straight rolls evidently did not result in uniform sheet. The roll surface had to be shaped to optimize sheet flatness. This modification aided tangibly in holding strip thickness variation to a minimum, as well as controlling flatness and straightness (SMC 1952a:20).

By 1850 the Scovill rollers were so accurate in producing uniform dimensions that sets of Scovill strip samples with sizes marked upon each were used by other brass manufacturers as industry standards (HAER No. CT-153-116). In 1858 Brown & Sharp Gauges became universally accepted in the metal working trades and replaced Scovill strips (SMC 1952a:20).

Brass hardened as it was cold-worked by rolling, drawing, forging or other mechanical operations (SMC 1952a:16). The effects of work hardening had to be removed by annealing. Annealing softened the brass to permit additional rolling to a thinner gauge or stamping. Hardwood fired muffle furnaces were used to anneal brass at first. Later hard coal, oil, coal gas and propane were used successively as fuel (SMC 1952a:20).

The soapstone, cast iron, mild steel and copper molds were obsolete by the second decade of the twentieth century. Occasionally the old molds would be used for special alloys, development work or small orders. The copper water-cooled mold began to supersede the cast iron molds starting in the 1920s (HAER No. CT-153-128). These molds produced a better surface, could be cycled faster and required less skill to use.

Fork lift trucks, electric cranes and mechanized handling equipment reduced the need for heavy labor in the 1930s and allowed handling of larger quantities of materials and castings than could be handled by human labor alone. In the 1920s the industry experimented with electric powered high-frequency induction furnaces and carbon arc furnaces. They were expensive to install and in brass industry conditions, expensive to operate. Low-frequency induction furnaces were also used but because of refractory material limitations, could not be used with brass alloys containing more than 70% copper. Nevertheless they were efficient, cost-effective and began to replace pit fires (HAER No. CT-153-123, 126). The electric furnaces displaced all but a few of the old pit fires by the mid-30s. By 1940 induction furnace and refractory technology advanced to the point where the low-frequency furnaces could be used at temperatures of 1350 degrees C. (2463 degrees F.). This was the highest temperature typically used in the brass industry (Hull 1950:39).

During the late 1940s Scovill developed revolutionary technology that displaced the batch methods of melting brass alloys and slab casting in water cooled molds. Continuous casting automated much of the processing and established a new landmark in brass processing technology.

Continuous Casting

Casting evolved into a continuous operation. Scovill engineers developed a unique flat-metal continuous casting machine which went into production together with an integrated continuous strip mill (SMC 1952a:23, 24).

In 1949 Scovill placed this modern continuous strip mill on stream. The new plant cost $10 million and consolidated the casting process with the strip rolling mill. The concept was adapted from a continuous steel casting process developed in Germany. The Rossi-Junghans continuous casting machine turned out 2000 lb. slabs averaging 2 1/2 inches thick, 24 inches wide and 10 feet long (Figure 15). A second machine was devoted to the production of round billets for rod and wire production (Sperry 1949:60). The new mill was an integrated operation and contained all necessary equipment for processing cold rolled brass, from the continuously produced slabs to the final packaged finished mill product.

The materials handling in this plant was highly automated. Manual handling was essentially eliminated. The upgraded plant environment -- improved lighting, ventilation and materials flow -- made for substantially improved working conditions.

At the core of the mill was Scovill's exclusive continuous flat-metal casting machine (Figure 16). Alloys were melted in three electric induction furnaces, each capable of producing 10,000 lb. per hour. Every half-hour each furnace discharged into a holding furnace of 9000 lb. capacity. This furnace fed a continuous flow of molten metal to the water cooled mold below it. The mold opening defined the width and thickness of the slab being cast. The mold was oscillated vertically to keep the solidified skin of the casting from sticking to the mold. As soon as the molten metal contacted the cold mold it formed a solid skin which contained the still-molten center. The slab then passed through a series of spray cooling rings which cooled the casting and induced solidification in the center of the casting.

As it emerged from the cooling coils, a horizontally mounted cut-off saw assembly was hydraulically clamped to the moving slab, allowing the entire saw assembly to move downward in synchronism with the slab speed. The saw cut the slab to a set length of 10 feet. The hydraulic clamps then released and allowed the slab to drop into a basket. The basket rotated to place the slab on a roller table.

The edges and corners of the slab were trimmed on a milling machine. The slab then proceeded down the line through a series of rolling mills and annealing furnaces (Figure 17)[13]. After several passes through the rolling mills it was thin enough to be coiled.

The rolling mills evolved into machines running at surface speeds of 1000 feet per minute producing roll coils weighing about 2000 lbs (SMC 1952a:23). As of 1952, coil weights were going up to 3,000 lbs. each. Coils could be up to a mile long without welds. The strip would also be cleaned and treated with acid ('pickled') to remove oxide scale and dirt during the rolling process.

Coils were uncoiled for inspection and slitting to final width, then they were re-coiled and shipped. Figure 18 shows the location of the components of the casting mine and strip mill. Some brass strip was used in the Scovill Manufacturing and other divisions to produce some of the 250,000 individual products made by the company.

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[13] The process of rolling causes the metal to "work-harden" and lose ductility. Heat treating or annealing eliminates the stresses built up in the metal by rolling or other process which deform it. This annealing allows additional rolling to be performed. To reduce a 2 1/2 inch slab down to a strip a few thousandths of an inch thick, many rolling - annealing cycles would be performed.

Structures

Architecture

The extant buildings at the Scovill site in Waterbury constitute an interesting cross-section of types of industrial architecture that were popular between the mid-19th and early 20th centuries.[14] Most are in a physical condition that would classify them as possessing minimal integrity to be considered potentially eligible for the National Register of Historic Places.

Some of the earlier remaining buildings, Numbers 1, 2, 3, 4, 6, 7, 8, 20, 21, and 22, survive as good examples of mid-to-late 19th century, large scale factory architecture.[15] These buildings are concentrated on the West Plant site. In particular, Building 2 is a rare example of a Rundbogenstil facade, wherein the entire Mill Street elevation is articulated as a series of blind arcades that are, in turn, pierced by arched and trabeated window openings. There are relatively few buildings of this style in Waterbury and the state. The openings are enlivened by stone headers and sills with drafter margin edges, a decorative element that is rarely found on factory buildings. The corbelled cornice with its decorative arches is a standard feature of the style. The Rundbogenstil motif is continued in building 1, but it is expressed in more exotic materials including marble window sills, and sand-struck, buff-colored brick.

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[14] The following discussion will refer to individual building numbers that correspond to those building number designations on Figures 2A and 2B.

[15] Please refer to Appendix D, the Factory Building Information: 1978 provided by Shannon Property Management, for an approximate construction date of each of the Scovill structures.

These represent HAER Photo Index Numbers:

Photograph	Building(s)	Photograph	Building
CT-153-1	1, 2	CT-153-9	7
CT-153-2	1, 2, 3	CT-153-8	8
CT-153-3	2, 3, 4, 20, 21	CT-153-10	7, 8
CT-153-4	2, 3	CT-153-12	7, 8
CT-153-5	2, 3, 4	CT-153-17	20
CT-153-41	6	CT-153-19	22

The German Romanesque origins of the Rundbogenstil are further expressed in the tower between buildings 3 and 4 (HAER No. CT-153-7). Its tall blind arches and corner buttresses contribute to the image of a Romanesque bell-tower. Buildings 3 and 4 should further be noted for their cornices. Corbelled brickwork creates an almost uniform denticulated cornice. On building 4 this cornice curves in response to the heads of the segmental arched windows of the uppermost floor.

According to a 1922 internal memo, Building 3 "is the original and only building on the plant of the date of 1850" (Main 1922: Memo #3; Figure 4). In these early buildings, the internal structure is typical for the period. They are generally built from heavy-timber "fireproof" mill construction. Star-shaped wall ties help link the strueture to the brick walls. The brick is generally 4 or 5 course American bond.

The brick chimney stack that was formerly connected to building 11 , adjacent to Mill Street in the West Plant, is a very good example of its type and one of few that has not been altered by an increase in height. When the smoke stack was erected, 1876, it was connected to a temporary wooden building. This building was replaced with a brick structure in 1877 (Main 1922: Memo.#3). The building does not survive today (HAER No. CT-153-13).

The next group of buildings, consisting of buildings 20 - 23, continue many of the characteristics of the earlier buildings such as brick construction and segmental arched window heads, but of particular note are the projecting open bed pediments that adorn the pavilions of building 22 (HAER No. CT-153-19). This classical detail is rarely seen in a factory setting. Building 32 would also seem to date from this period and should be noted for the massive open span breasted by the immense wood and wrought iron trusses that support the roof (HAER Nos. CT-153-21-25).

The structures built from c.1900 - 1905 (buildings 40 - 55; HAER Nos. CT-153-26-54) possess a surprising degree of architectural interest. Of particular note is the facade treatment. The windows and their spandrels are recessed slightly, thereby emphasizing the verticality of the remaining portions of the wall. Although there is some evidence of the relatively early use of concrete in this portion of the plant, the majority of the structure is supported by a modified version of standard wooden, mill-type, construction.

Buildings 71, 71A, and H12, which ring the northern side of the West Plant area, are quite notable. Buildings 71 and 71A (HAER Nos. CT-153-55-57) consist of concrete structural frames that are infilled with brick and metal-framed windows. Built during World War I, these buildings represent the last word in mill building technology c.1915 and are very similar to many of the arms plants that were being built in Bridgeport, Connecticut at the same time, such as the giant "Russian Rifle" plant. The Neoclassical entry at H12 (HAER Nos. CT-153-15, 16) is a rare survivor of this type of monumental entry.

The area known as the East Plant is generally less distinguished architecturally than its counterpart to the west, but there are several buildings that are of merit. Buildings 153 and 153A are of little historic interest architecturally. Buildings 109 (HAER Nos. CT-153-93-95) and 112 (HAER Nos. CT-153-93-96,97) continue the trend established by building 71, while buildings 118 and 127 (HAER Nos. CT-153-98-101), with arcaded transformer bays, are rare examples of Neoclassical style transformer buildings. Building 136 (HAER Nos. CT-153-102,103) is a rather standard, 20th century factory building of little architectural interest. Bridge 78B is a distinctive form on the site (HAER Nos. CT-153-67, 92), spanning the Mad River and providing pedestrian access to daily laborers.

Building 75 (HAER Nos. CT-153-77-80, 111), the power plant, is an elegant example of such power-source structures created for industrial sites. It has beautiful massing and appropriately strong details. It is one of the architectural highlights of the entire project site.

The massive structure made up of buildings 68, 72, and 145 (HAER Nos. CT-153-69, 72, 73, 74, 76, 104), is impressive by its size alone. The vast area of saw-tooth skylight roof and blue ventilators creates an overpowering image, and was state-of-the-art for the period of its construction. However, the loss of much of the glass in the skylights, and the removal of a great deal of steel when the process equipment was removed, has destroyed the integrity of the building.

Technological Significance

The history of Scovill is a notable chapter in the annals of Connecticut industry. Throughout most of its 175 years, Scovill was an innovative, entrepreneurial, venturesome business. Its engineers developed highly original manufacturing methods and made quality parts to high tolerances at low prices. The 90 acre site was a completely integrated facility, generating its own steam and electricity and capable of accomplishing all necessary manufacturing operations on site. Alloying elemental metals, casting, foundry operations, rollings, forging, stamping, plating, japanning, molding are just a sample of the procedures carried out at the facility.

Yet, Scovill maintained some anachronistic procedures that contributed to high operating expenses. The company maintained a blacksmith and machine shop that could make repair parts for virtually any machine at the plant. As a rule this shop continued to make tools and equipment for in-house use that could have been bought on the open market at less cost. Even such minor items as tweezers or transport barrels were made rather than bought.

One development, the continuous casting plant and strip mill, surely ranks as a major advance in modern metallurgical process technology. The plant came on-stream in 1949. Scovill's adaptation of continuous steel manufacturing technique, under the direction of William Cleveland, Chief Engineer, was ahead of its time. The term 'Automation' was not in general use, it was coined about the time Scovill was designing its line. Scovill used the term 'automaticity' to describe the operating concept of its continuous line. The project anticipated developments in factory automation by twenty years and stands and a major landmark in the history of metallurgy.

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APPENDIX A

CHRONOLOGY & PRODUCTS

1802 Abel Porter & Company set up shop in building at 355-359 S. Main Street - Products:

- tin and pewter alloy buttons
- cast and stamped brass buttons
- gilt buttons of all the above (Abel may have been the first to gild buttons in America)

1806-09 Began making cold rolled brass strips for buttons in the Main Street shop

1811-12 Leavenworth & Scovill (moved to Mad River grist mill)
Government contract for military buttons for War of 1812, different designs for the different divisions (artillery, rifleman, etc. as well as different branches of service)

1813 Wool cloth for uniforms from mill on present Scovill property near dam at John D's pond

- buckles

1814-15 Leavenworth, Hayden & Scovill formed

1827 J.M.L. Scovill & W.H. Scovill formed

1830s Brass butt hinges for furniture & doors

- snuffer trays
- belt ornaments & other small brass goods
- cloth buttons
- sheet brass
- brass wire

1834-41 Minted coins, over 200 designs, used as currency into 1840s, U.S. took over in 1842

1840s Kerosene & whale oil lamps

- political slogan garment buttons (Harrison's Log Cabin buttons)

1842 Began manufacturing high quality copper/silver plate daguerreotypes, largest American manufacturer of these until photography progressed to a more advanced process
cameras & photographic equipment (was Anthony & Scovill, now ANSCO) metal daguerreotype cases, preservers & cases

1850 Scovill Manufacturing Company all departments incorporated
by 1850 owns a New Haven clock manufacturing facility

1850s Began rolling German Silver
sheet metal copper plated w/silver, gold or platinum by a process developed by Eugene Martin, a 20 year employee, who received patent for process in 1870s - this metal used for coach lamps, carriage & harness trimmings & similar articles
daguerreotype cases, preservers, mats

1860s Expanded lamp and lantern line as petroleum products became more available
hooks, eyes, tacks & snaps
curtain trimmings
sheet brass market for munitions depending on "level of belligerency"

1866 Blanks to government for 3 cent nickel coin

1880s Experimentation in manufacture of aluminum goods, small, personal items, jewelry,

1883 Transferred plastics manufacture to Waterbury, made buttons, knobs, cigar molds, poker chips, billiard balls

1890 Blanks to government for 5 cent nickel coin and 1 cent bronze coin

1893 23,757 medals for Columbian Exposition "greatest achievement in history of the country in the line of medal making," devised new machinery & processes for their production

1898 Began "making some munitions" not just sheet for them

1914 Made munitions for foreign concerns
time fuses
shrapnel shell cases

1917 Began munitions manufacture for U.S., continued through World War II
1920's acquired Hamilton Beach, Oakville Co. (safety & straight pins), A. Schrader & Sons (tire valves)

1923	Purchased American Pin Co. (in Waterbury) pins, hooks, eyes
1952	Still producing buttons for U.S. Air force
1967	Purchased NuTone (built-in appliances)
1970's	Purchased Dominion Electric (small appliances), and a division of Westinghouse
1976	Sold Waterbury site to Century Brass
1978	Scovill purchased Bellows International (with A. Schrader & Sons made Scovill a big in the production of fire extinguishers, propane torches, pressurized heaters, refrigeration & air conditioning units, air control products used in automated production)
1979	Purchased Eaton Corporation locks & hardware division (became maker of Yale locks)
1981	Scovill Corporate Headquarters located on Chase Parkway retained Hamilton Beach sales & engineering office on Mill Street. Owned an apparel fasteners factory in Watertown (only New England production facility left)
1988	Corporate headquarters moved to Stamford, without public notice Hamilton Beach division, in Croft Commons, Waterbury, sold in 1986

APPENDIX B

Major partners/owners of Scovill Manufacturing Company: 1802-1850

1802 Abel Porter & Company
Abel Porter, Levi Porter, Silas Grilley, Daniel Clark, David Hayden (1804)

1811 Leavenworth & Scovill
Dr. Frederick Leavenworth, James Scovill, James Mitchell Lamson Scovill

1814 Leavenworth, Hayden & Scovill
Dr. Frederick Leavenworth, David Hayden, J.M.L. Scovill

1827 J.M.L. Scovill & W.H. Scovill
J.M.L. Scovill, William Henry Scovill

Subsidiary companies:

> **1830s Scovills & Buckingham (Oakville)**
> Scovill brothers and John Buckingham
> **1830s W.R. Hitchcock & Co.**
> W.R. Hitchcock, Joseph C. Welton, Scovill brothers
> **1839 Scovills & Co.**
> Scovill M. Buckingham, Abram Ives

1850 Scovill Manufacturing Company
J.M.L. Scovill, President

APPENDIX C

Waterbury Population by Country of Birth

Country of Birth	1850	1876	1890	1900	1910	1920
Canada - French	9	98	1362	1777	1901	1521
Canada - Other				489	401	494
England & Wales	286	403	724	982	1243	1086
Germany	23	385	887	1195	1433	1010
Ireland	1038	3642	5402	5866	5838	4507
Italy	0	4	308	2007	6567	9232
Lithuania	0	-	*	*	*	3674
Poland	0	12	102	*	*	1629
Russia	0	-	123	1265	5600	3209
U. S. Blacks	21	87	186	540	775	951

* Note: In 1890, 1910 Lithuanians were enumerated as Russians. In 1900, 1910 Poles were enumerated as Russians, Germans or Austrians.

Waterbury Population Growth

Year	Population	Growth rate: % change/decade
1790	2937	-
1800	3256	10
1810	2874	-11
1820	2282	-20
1830	3070	34
1840	3668	19
1850	5137	40
1860	10004	94
1870	13106	31
1880	20270	54
1890	33202	63
1900	51139	54
1910	73141	43
1920	91715	25

Source: U. S. Census (Bucki 1980a)

APPENDIX D

1978 FACTORY BUILDING INFORMATION[16]

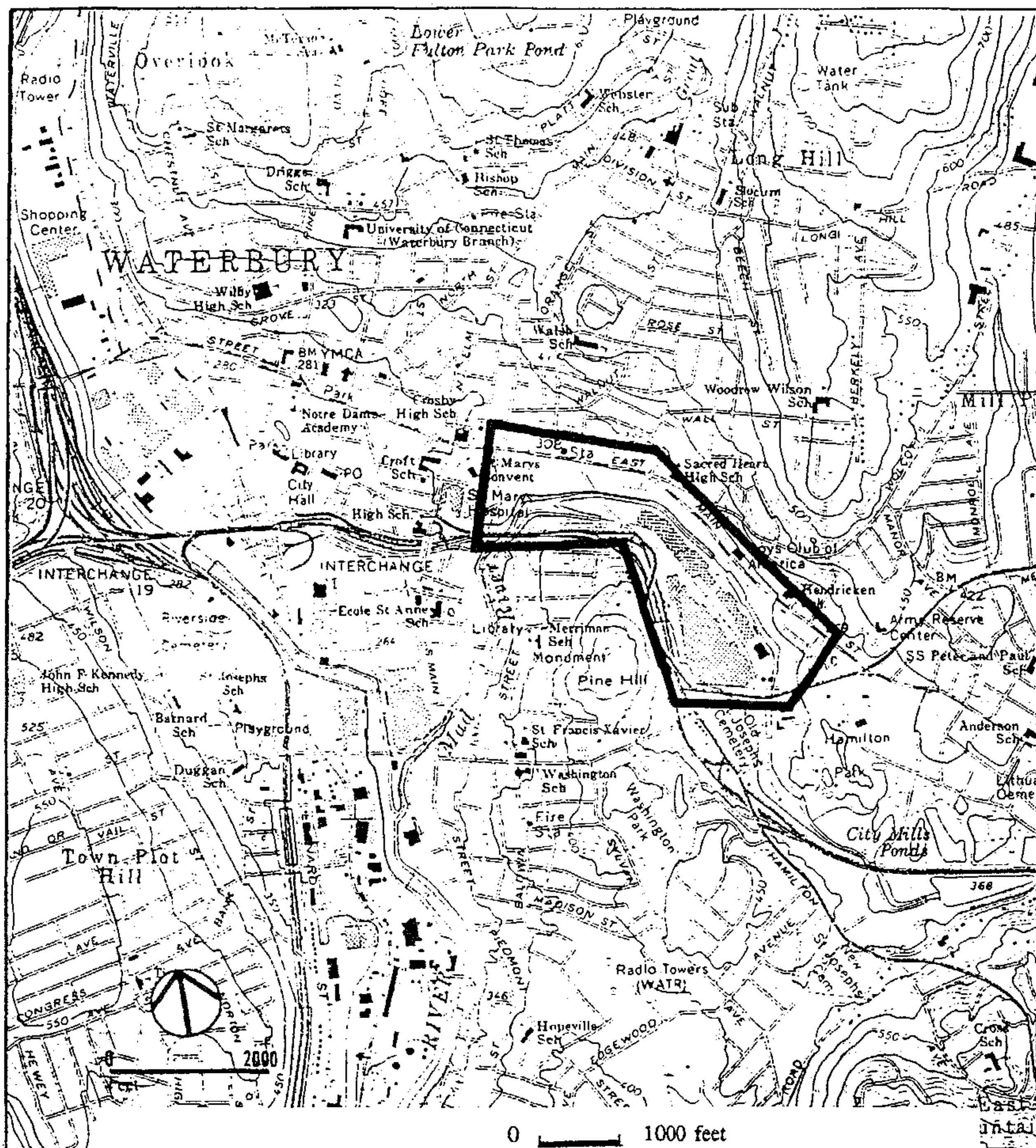
Building #	Date	Function
1	after 1896	Office
2	by 1876	Reception & Finance Office
3	by 1852	Offices
4	1893	Offices
6	1912	Offices
7	1896	Electrical Instrument Calibration & Maintenance
8	1882	Offices
11	1889	Blacksmith Shop (includes 11A-1915 and 11 B-1919)
14	1869	Old Wire Mill (demolished for I84)
20	1906	Hamilton Beach Division & Engineering
21	by 1860	Tunnels
22	1881	Engineering (possibly constructed earlier)
23	1893	Hamilton Beach & Engineering
30	1914	Grinding Room (original casting room pre-1947)
32	1881	Machine Room & Stamping
33	1891	Press Room
34	1923	Passageway
35	1890	Rolling Mill
35A	1916	Welding Shop & Extension
36	1916	Dip, Buff & Clean Area
38	1923	Anodizing & Aluminum Finishing
39	1898	Press Room
40	1895	Solenoid Coil Production (5th floor- 1900)
41	after 1896	Buffing Room (5th floor)
41A	after 1896	Electroplating Shop
43	1919	Main Air Compressors
43A	1909	Steam & Hot Water Heating Plant
44	1901	Generator room
45	1912	Original Rolling Mill (pre 1945) (includes 45A)
46	1912	Box Making Shop
46A		Shipping Dock

[16] To correlate building numbers with the physical plant, see Figures 2A and 2B.

Building #	Date	Function
47	1903	Press Room (includes 47A- 1915)
48	1905	Tool Room
49	1905	Hose Coupling Production Building
49A	1905	Dipping Operations
50	1905	Stamping Operations & Tool Room
51	1911	Electric Annealing Operations
52	1909	Passageway
53	1909	Shipping (basement)
55	1910	Connecting Bridge
57	1924	Electric Annealing Operations
65	1914	Saws & Cleaning
65A	1917	Hot Forge Shop
65B	1917	Carpenter Shop & Wire Mill
65C	1942	Tool Room
65D	after 1896	Press Room
68	1917	Rod & Tube Mill
68A	after 1896	Machine Room
71	1917	Eyelet Production
71A	1917	Spray Paint, Lacquer & Vernathon (thermostat)
72	1917	Casting Shop
75	1917	Power House (includes 75A & 75B)
78	1915	Locker room
86	1918(?)	Metals Research & Analysis Lab
101	1917	Scrap Receiving
103	after 1896	Shipping
109	1918	Toilet Ball Cock Fabrication, Slide Fasteners (zippers), Automatic Screw Machines
110	1917	Welding Shop
112	1917	Slide Fasteners, Automatic Screw Machines
128	1920	Horse Shed
136	1941	Press Room
140	1943	Wire Mill
140A	after 1896	Shipping
143	1944	Garage
145	1947	Strip Mill
145A	after 1896	Cleaning, Stamping & Remnant Orders, Planer for 'Chip' Removal

Building #	Date	Function
148	1953	Shipping & Receiving Docks
150	1955	Employment Office & Hospital
151	1953	Shipping
153	after 1896	Grenade Fuses (includes 153A- 1972)
154	1970	Chip Dryer
155	1971	Shipping Docks

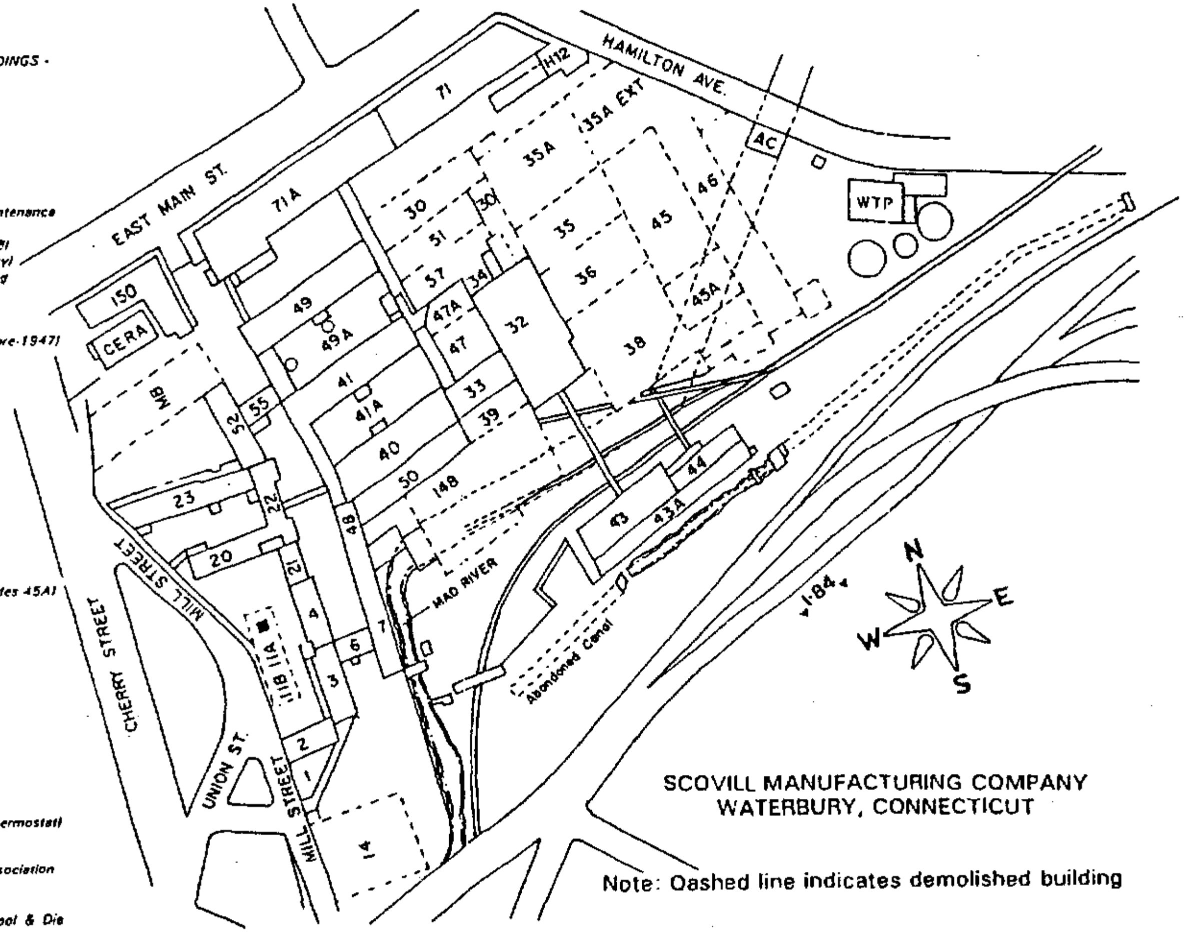
CERA	after 1896	Century Employee's Recreational Association
WTP	after 1896	Water Treatment Plant
AC	after 1896	Acid Shed
MB	after 1896	Machine Room, Buff Room, and Tool & Die



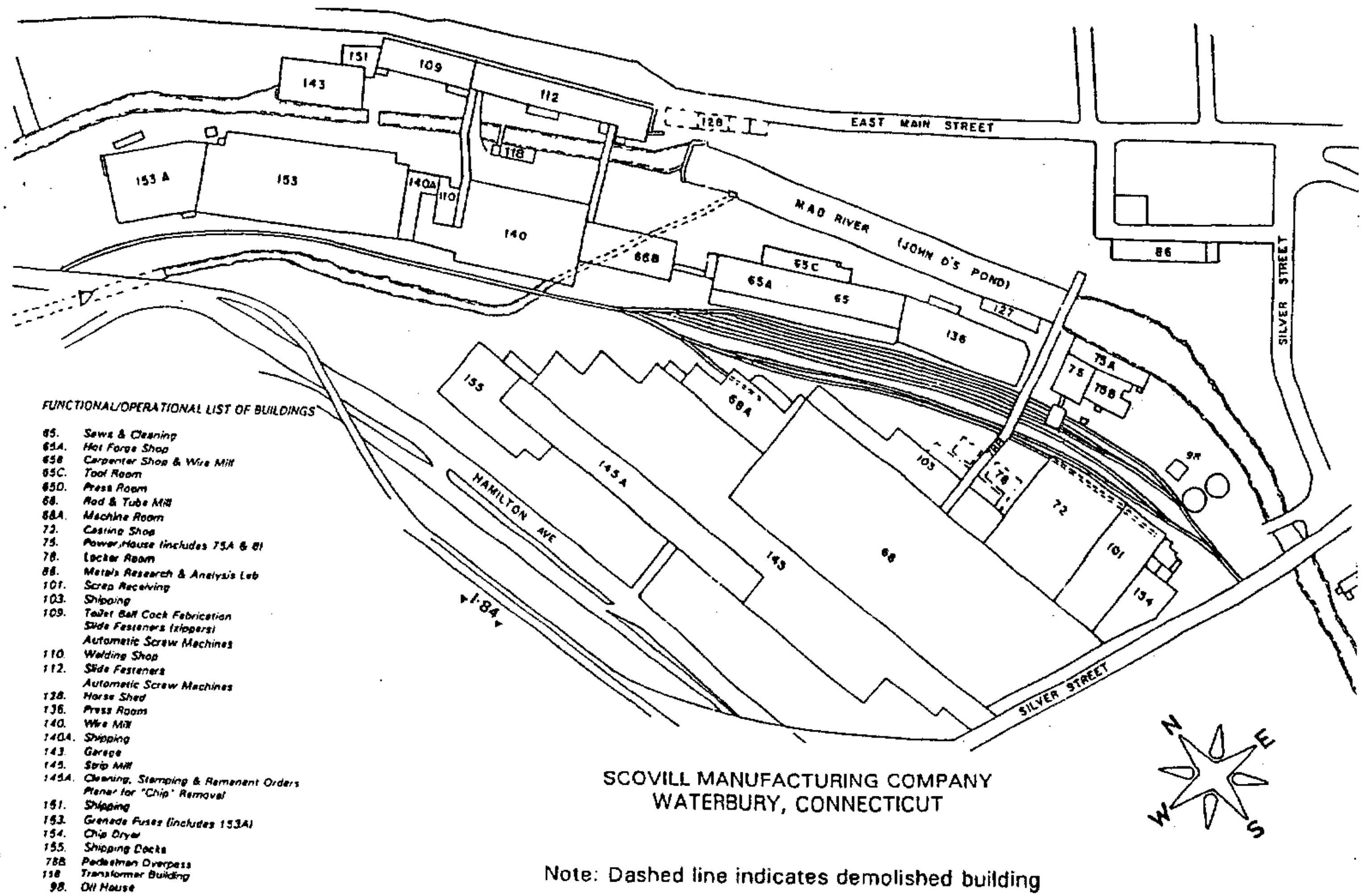
LOCATION OF SCOVILL BRASS WORKS IN WATERBURY, CONNECTICUT
UTM Coordinate letters shown. Base Map: Waterbury, Connecticut
USGS Quadrangle 1971

FUNCTIONAL/OPERATIONAL LIST OF BUILDINGS -

1. Office
2. Reception Area & Finance Office
3. Offices
4. Offices
6. Offices
7. Electrical Instrument Calibration & Maintenance
8. Offices
11. Blacksmith Shop (includes 11A & 11B)
14. Old Wire Mill (Demolished for Highway)
20. Hamilton Beach Division & Engineering
21. Tunnels
22. Engineering
23. Hamilton Beach & Engineering
30. Grinding Room (original casting room pre-1947)
32. Machine Room & Stamping
33. Press Room
34. Passageway
35. Rolling Mill
35A. Welding Shop & Extension
36. Dip. Buff & Clean Area
38. Anodizing and Aluminum Finishing
39. Press Room
40. Solenoid Coil Production
41. Buffing Room (5th floor)
41A. Electroplating Shop
43. Main Air Compressors
43A. Steam & Hot Water Heating Plant
44. Generator Room
45. Original Rolling Mill (pre-1945) (includes 45A)
46. Box Making Shop
46A. Shipping Dock
47. Press Room (includes 47A)
48. Tool Room
49. Hose Coupling Production Building
49A. Dipping Operations
50. Stamping Operations & Tool Room
51. Electric Annealing Operations
52. Passageway
53. Shipping (Basement)
55. Connecting Bridge
57. Electric Annealing Operations
71. Eyelet Production
71A. Spray Paint, Lacquer & Vernathon (Thermostat)
148. Shipping & Receiving Docks
150. Employment Office & Hospital
CERA Century Employee's Recreational Association
WTP Water Treatment Plant
AC Acid Shed
MB Machine Room, Buff Room, and Tool & Die Making (demolished)
H12 Entry Gate



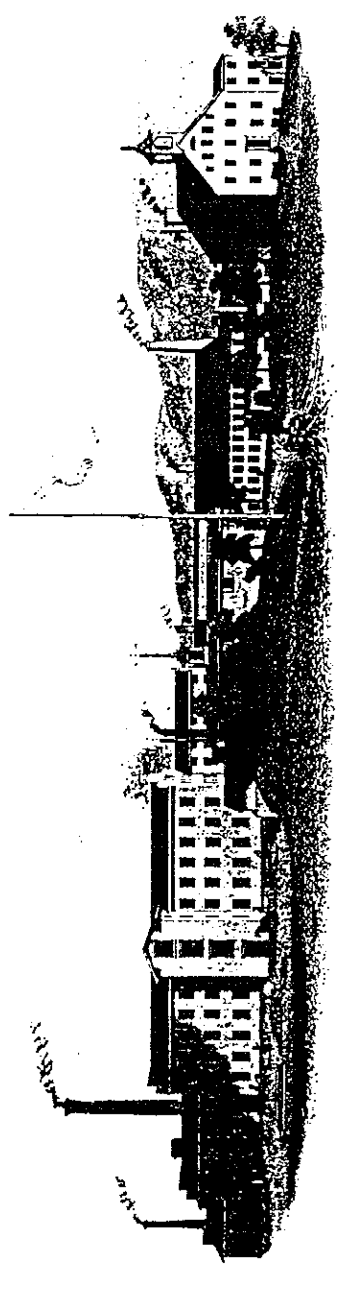
Scovill Manufacturing Company - West Plant Layout, c. 1977



SCOVILL MANUFACTURING COMPANY
WATERBURY, CONNECTICUT

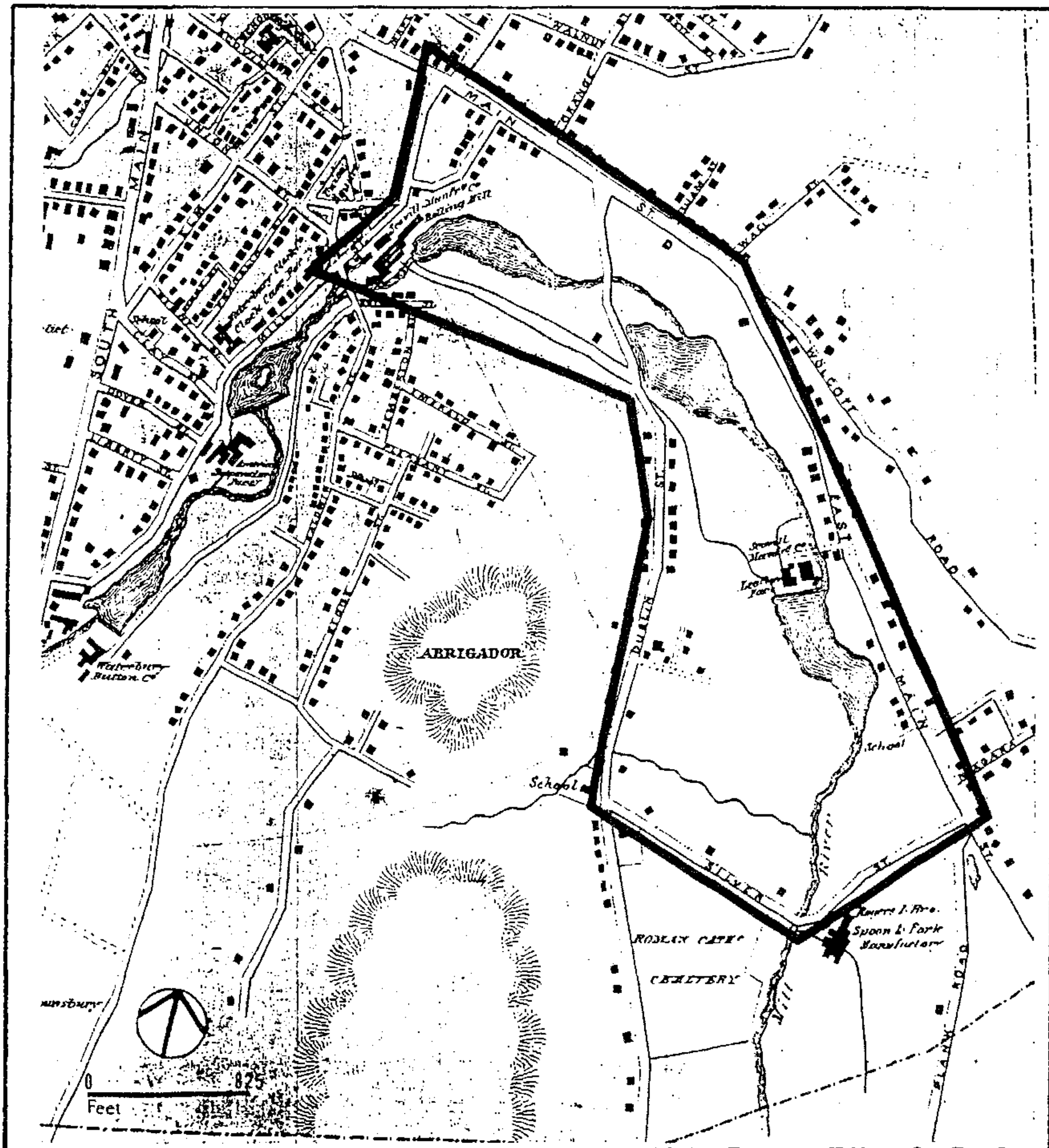
Note: Dashed line indicates demolished building

Scovill Manufacturing Company - East Plant Layout, c. 1977



1858 Lithograph "View of the Scovill Mf'C. Co's Works"
Bronson 1858:496

1858, View of the Scovill Manufacturing Company's Works

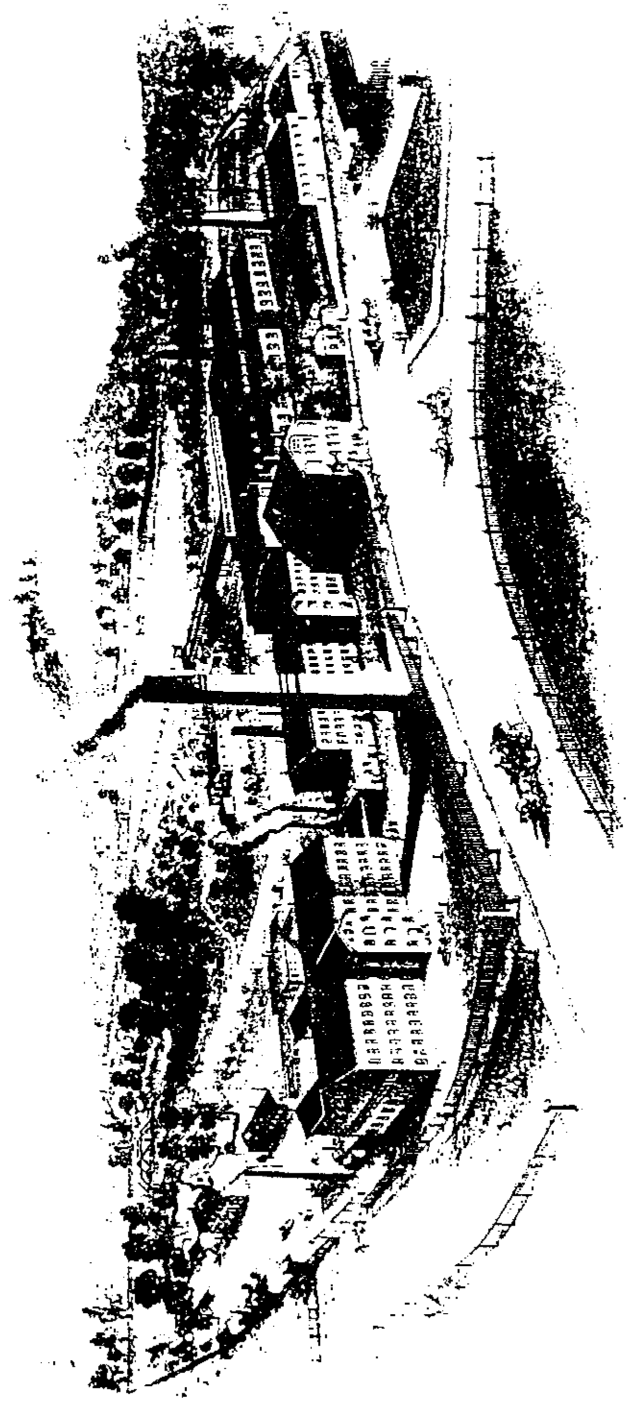


1868 Beers, Ellis & Soule
Plan of the City of Waterbury, Connecticut

Overlay of the Scovill Brass Works property

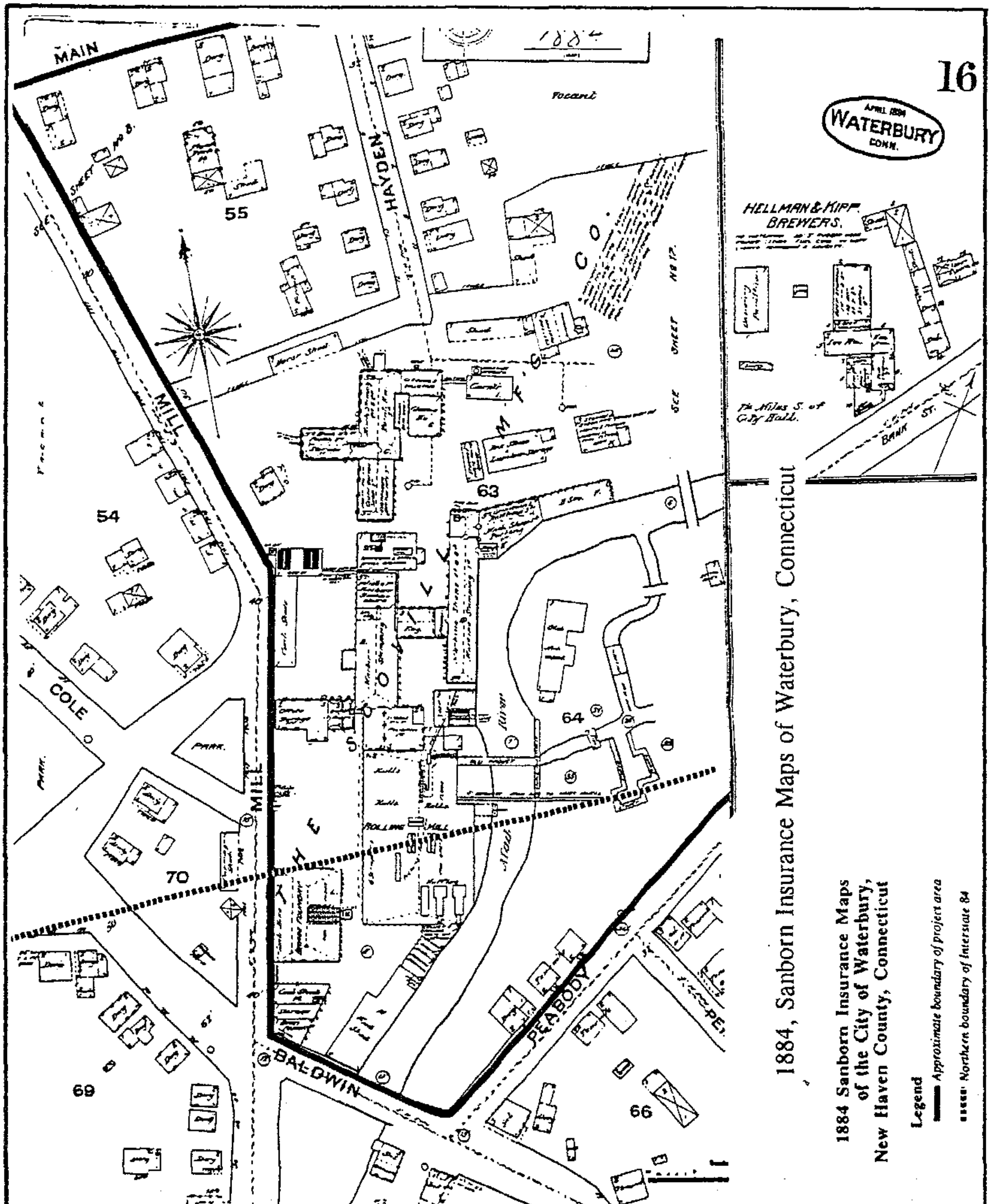
Legend

Approximate boundary of project area



1879 Lithograph of the Scovill Manufacturing Company
Bassett 1888

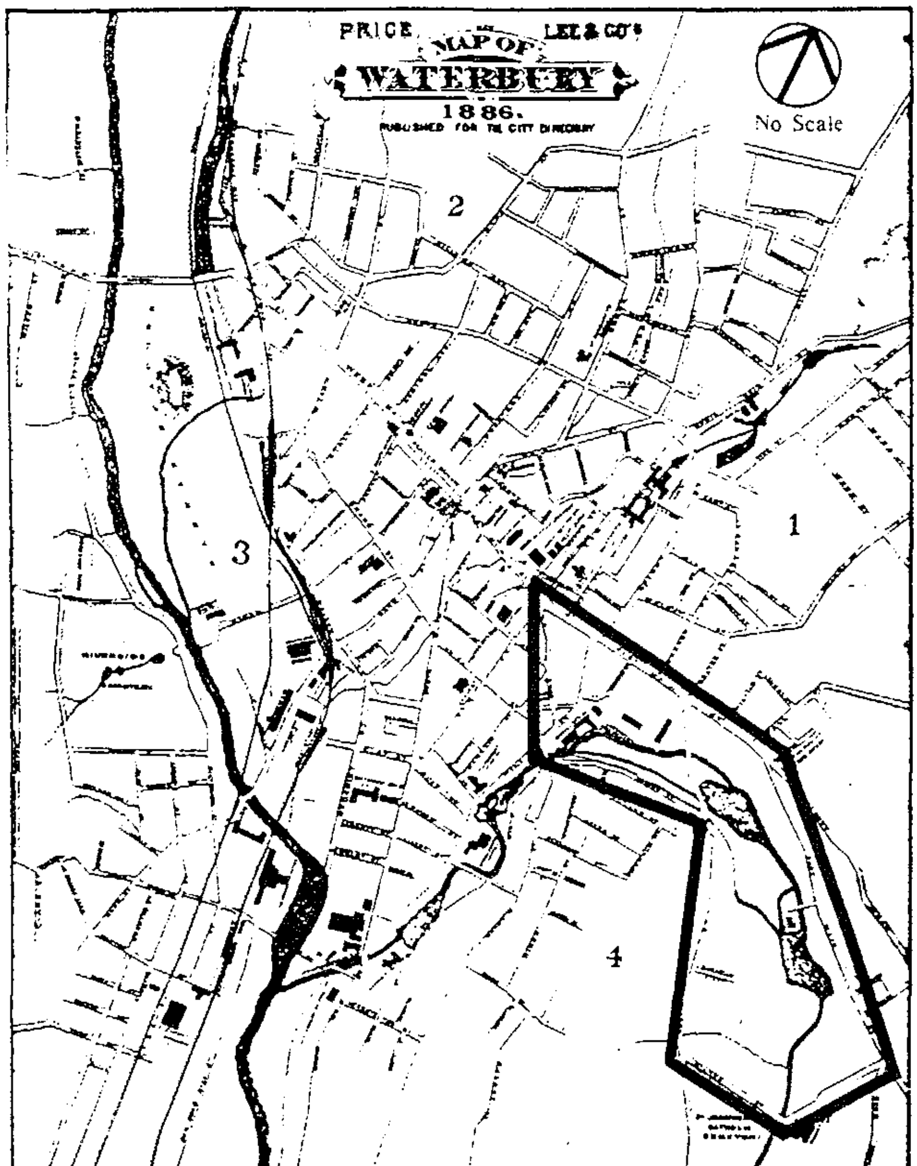
1879, Scovill Manufacturing Company



1884, Sanborn Insurance Maps of Waterbury, Connecticut

1884 Sanborn Insurance Maps of the City of Waterbury, New Haven County, Connecticut

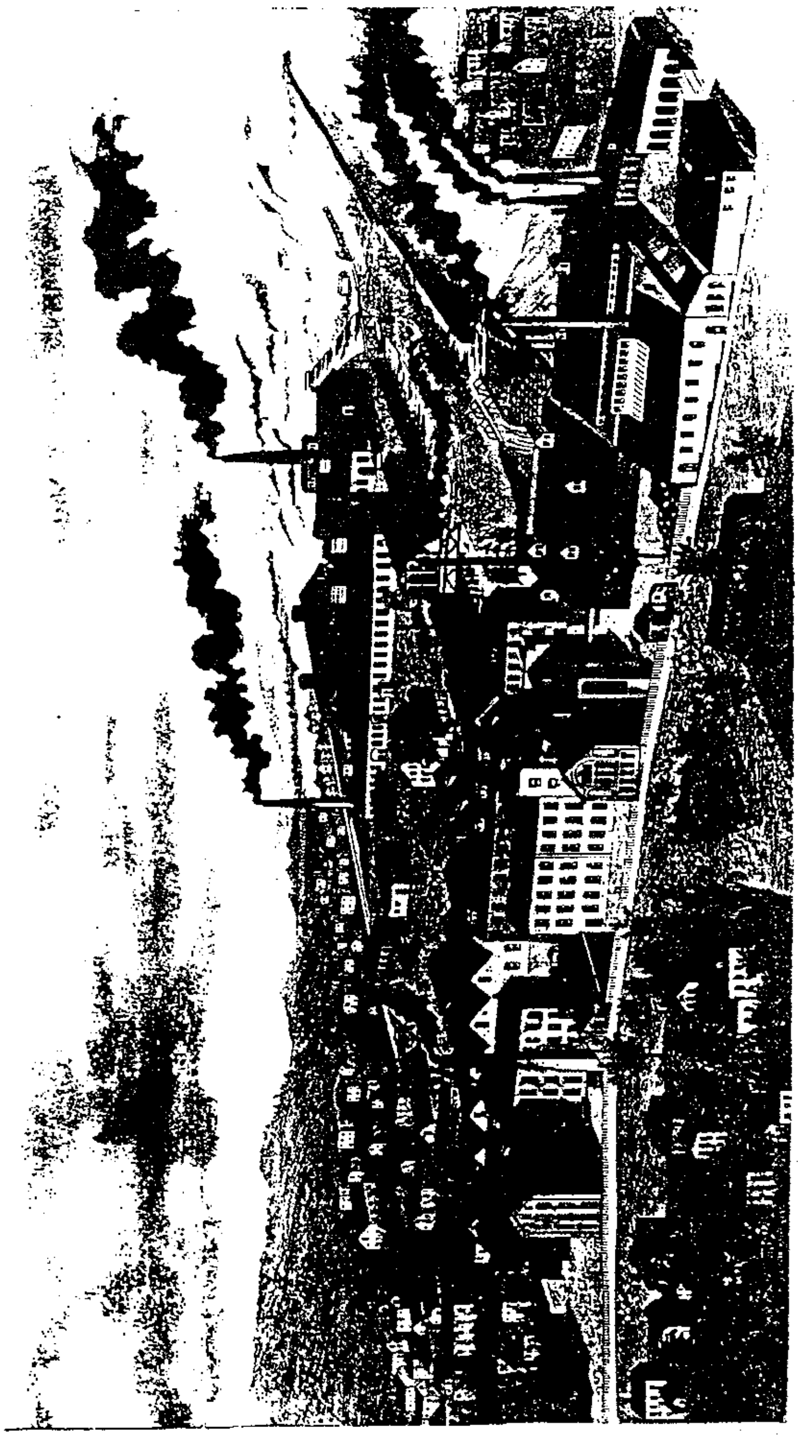
Legend
Approximate boundary of project area
Northern boundary of Interstate 84



1886 Price, Lee & Co's. Map of Waterbury

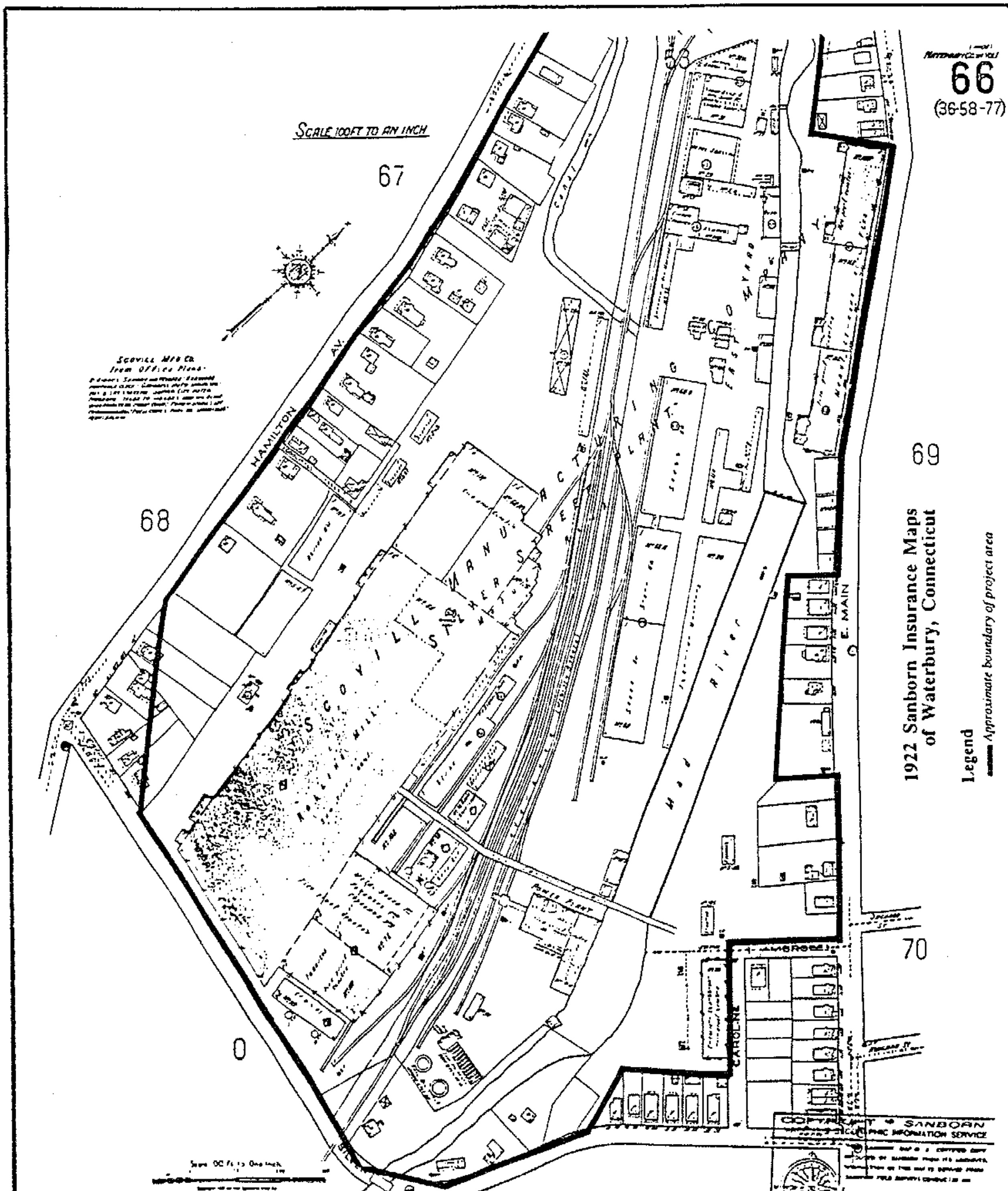
Legend

Approximate boundary of project area

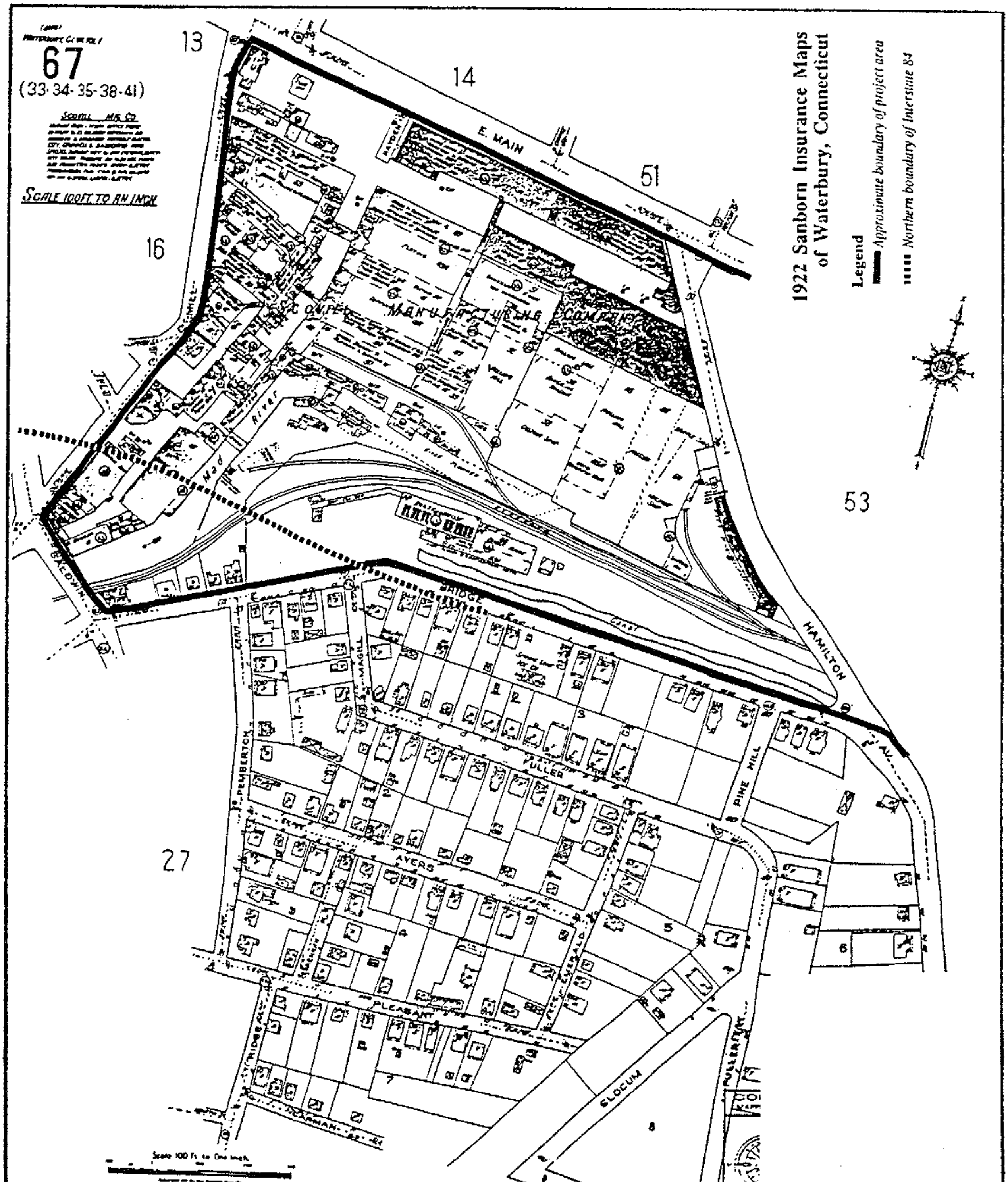


1894-96 Lithograph of the Scovill Manufacturing Company
Anderson Vol. II:274

The Scovill Manufacturing Company in 1896

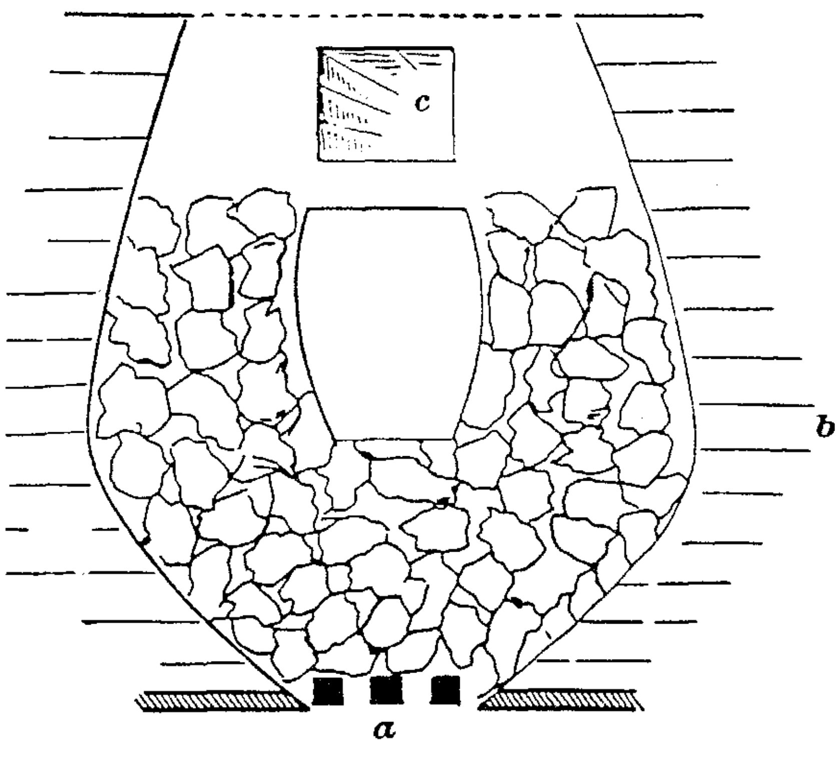


1922, Sanborn Insurance Maps of Waterbury, Connecticut, East Plant



1922, Sanborn Insurance Maps of Waterbury, Connecticut, West Plant

A Pit Furnace for Brass



The shape of the furnace was critical for efficient operation. Over many years a configuration had been developed which concentrated the heat at the 'line of melting' (b). Air was admitted at the grate (a) which was sized to admit just enough air to control combustion. In theory this was enough to allow the air to expand 5.9 volumes at the widest portion of the pit at (b). The flue size (c) was also calculated to create just sufficient draft to maintain the proper heat for alloying brass. This was determined to be 12 inches square (Cairns c. 1880:2).

Design of Pit Furnaces for Brass